DOCUMENT RESUME

ED 302 631 CE 051 508

TITLE	Aviation Maintenance Technology. Airframe. A203. Aircraft Fabric Covering, Painting, and Finishing. Instructor Material.
INSTITUTION	Oklahoma State Board of Vocational and Technical Education, Stillwater. Curriculum and Instructional Materials Center.
PUB DATE	88
NOTE	158p.; Portions printed on colored paper. Photographs may not reproduce clearly. For related documents, see ED 279 822-827 and CE 051 507-509.
AVAILABLE FROM	Curriculum and Instructional Materials Center, Oklahoma Department of Vocational and Technical Education, 1500 West Seventh Avenue, Stillwater, OK 74074-4364 (Order No. TI1207).
PUB TYPE	Guides - Classroom Use - Guides (For Teachers) (052) -- Tests/Evaluation Instruments (160)
EDRS PRICE	MF01/PC07 Plus Postage.
DESCRIPTORS	Aerospace Industry; *Aviation Technology; Classroom Techniques; Learning Activities; Learning Modules; Lesson Plans; *Maintenance; *Painting (Industrial Arts); Postsecondary Education; Repair; Secondary Education; State Curriculum Guides; Teaching Methods; Test Items; Transparencies
IDENTIFIERS	*Aircraft; Oklahoma

ABSTRACT

This teacher's guide is designed to aid teachers in leading students through a module on airframe building and repair, including fabric covering, painting, and finishing. The module contains two units that cover the following topics: (1) inspecting, testing, and installing aircraft fabric coverings and (2) applying dope, paint, and trim. Each unit follows a standardized format that consists of the following components: introduction and module objective, specific objectives, instructor's implementation guide, technical information supplements, transparency masters, workbook supplements, answers to workbook supplements, project guides, theory test, and answers to theory test. A course test with answer key completes the package. (KC)

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AVIATION MAINTENANCE TECHNOLOGY

AIRFRAME

A203 AIRCRAFT FABRIC COVERING, PAINTING, AND FINISHING

INSTRUCTOR MATERIAL

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MODULE OF INSTRUCTION
FOR
AVIATION MAINTENANCE TECHNOLOGY

AIRFRAME

A203 AIRCRAFT FABRIC COVERING, PAINTING, AND FINISHING

INSPECT, TEST, AND INSTALL AIRCRAFT FABRIC COVERINGS

A203-A

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INSPECT, TEST, AND INSTALL AIRCRAFT FABRIC COVERINGS
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INTRODUCTION

Fabric was one of the first materials commonly used for covering aircraft structure. This covering was to provide a lightweight means of creating an aerodynamic shape which would produce lift or reduce drag. Fabric covers are still used as coverings in the restoration of aircraft airframes, amateur-built aircraft, and agricultural aircraft. The aviation maintenance technician must have knowledge and skills related to this unique area of aviation maintenance in order to ensure that the aircraft using these types of materials can be maintained in accordance with the highest standards of airworthiness.

MODULE OBJECTIVE

After completion of this module, you will be able to demonstrate your ability to inspect, install, and repair fabric coverings. Your competency will be evaluated by completing workbook assignments, project guides, and by scoring 85 percent on the module theory test.

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SPECIFIC OBJECTIVES

After completion of this module, you should be able to:

1. Match terms related to inspecting, testing, installing, and repairing aircraft fabric coverings to their correct definitions. (1)	Technical Supplement #1
2. List approved data sources used to establish procedures for the installation of fabric coverings on aircraft. (1)	EA-ITP-AB 140-141 EA-ITP-AW 3:II:1 FAR 43 Appendix A EA-ITP-ASG 39:4-7
3. Explain what is meant by the phrase *approved materials* and how you can be sure you are using approved materials. (2)	EA-ITP-AB 141-142 AC 65-15A 85 Workbook Supplement #1 EA-ITP-ASG 39:8-11
4. Name the categories of aircraft still using fabric covering materials and processes. (1)	EA-ITP-AB 140-142 EA-ITP-AW 3:III:1 EA-ITP-ASG 40:12
5. Explain what is meant by the phrase *fabric covering system*. (1)	EA-ITP-AB 142-143
6. Select statements related to material characteristics and processes used in the reference (cotton and linen) covering system. (2)	EA-ITP-AB 139-140, 143-146 AC 65-15A 85-89, 108-109 AC 43.13-1A&2A 81 EA-ITP-AW 3:I, IV:1-4 EA-ITP-ASG 39:1-3 and 40-41:13-45
7. Discuss methods, time intervals, and fabric strength ratings to be used when determining the need for recovering a fabric structure. (2)	EA-ITP-AB 143, 146-147 AC 65-15A 106-107 EA-ITP-AW 3:IV:2 Workbook Supplement #1 EA-ITP-ASG 41:46-47
8. Select statements related to fabric removal from aircraft structure. (2)	EA-ITP-AB 147 Workbook Supplement #1 EA-ITP-ASG 41:48-49

9. Select true statements related to inspecting the aircraft structure and preparing it for recovering. (1)	EA-ITP-AB	148-149
	AC 65-15A	91-92
	AC 43.13-1A&2A	81-82
	EA-ITP-AW	3:IV:3
	Workbook Supplement #1	
	EA-ITP-ASG	42:50-57
10. Select statements related to procedures used to install cotton and linen covering systems. (2)	EA-ITP-AB	149-158
	AC 65-15A	89-99, 107-111
	AC 43.13-1A&2A	81-91
	EA-ITP-AW	3:IV:2-5
	Workbook Supplement #2	
	EA-ITP-ASG	42-44:58-99
11. Select statements related to materials and procedures used in the Dacron fabric system. (2)	EA-ITP-AB	158-160
	AC 43.13-1A&2A	81
	EA-ITP-AW	3:IV:2, 5
	EA-ITP-ASG	44:100-106
12. Discuss the glass cloth covering system. (2)	EA-ITP-AB	160
	AC 65-15A	88, 104
	EA-ITP-AW	3:IV:2, 5
	EA-ITP-ASG	45:107-110
13. Discuss fabric repairs. (2)	EA-ITP-AB	160-163
	AC 65-15A	99-103
	AC 43.13-1A&2A	95-97
	EA-ITP-AW	3:V:5-6
	Workbook Supplement #3	
	EA-ITP-ASG	45:111-114
14. Match specific repairs used on fabric covering to damage criteria. (1)	EA-ITP-AB	160-163
	AC 43.13-1A&2A	95-97
	Workbook Supplement #3	
15. Describe the acceptable condition of a fabric covering, in relation to the required strength and tautness, after the repair is complete. (2)	EA-ITP-AB	160
	AC 43.13-1A&2A	95
	Workbook Supplement #3	
16. Arrange in order the steps used to repair an L-shaped tear in fabric. (2)	EA-ITP-AB	160-161
	AC 65-15A	99-101
	Workbook Supplement #3	
17. Inspect and test aircraft fabric covering. (2)	Project Guide #1	
18. Install aircraft fabric covering. (2)	Project Guide #2	
19. Repair aircraft covering using a doped-on patch. (2)	Project Guide #3	

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INSTRUCTOR'S MODULE IMPLEMENTATION GUIDE

I. Order materials to supplement module:

A. *Stits Poly-Fiber Covering & Painting Manual*, Procedure Manual No. 1, Rev. 13, 2nd ed., January, 1983.

(NOTE: This is the revision referenced in the project guides. However, obtain the most current edition available for use with this module.)

B. *Stits Poly-Fiber Aircraft Coatings*, Catalog #200

(NOTE: This manual and catalog are available from Stits Poly-Fiber Aircraft Coatings, P.O. Box 3084, Riverside, CA 92519.)

II. Implementation Suggestions

(NOTE: Have students read all available resource material related to specific objectives.)

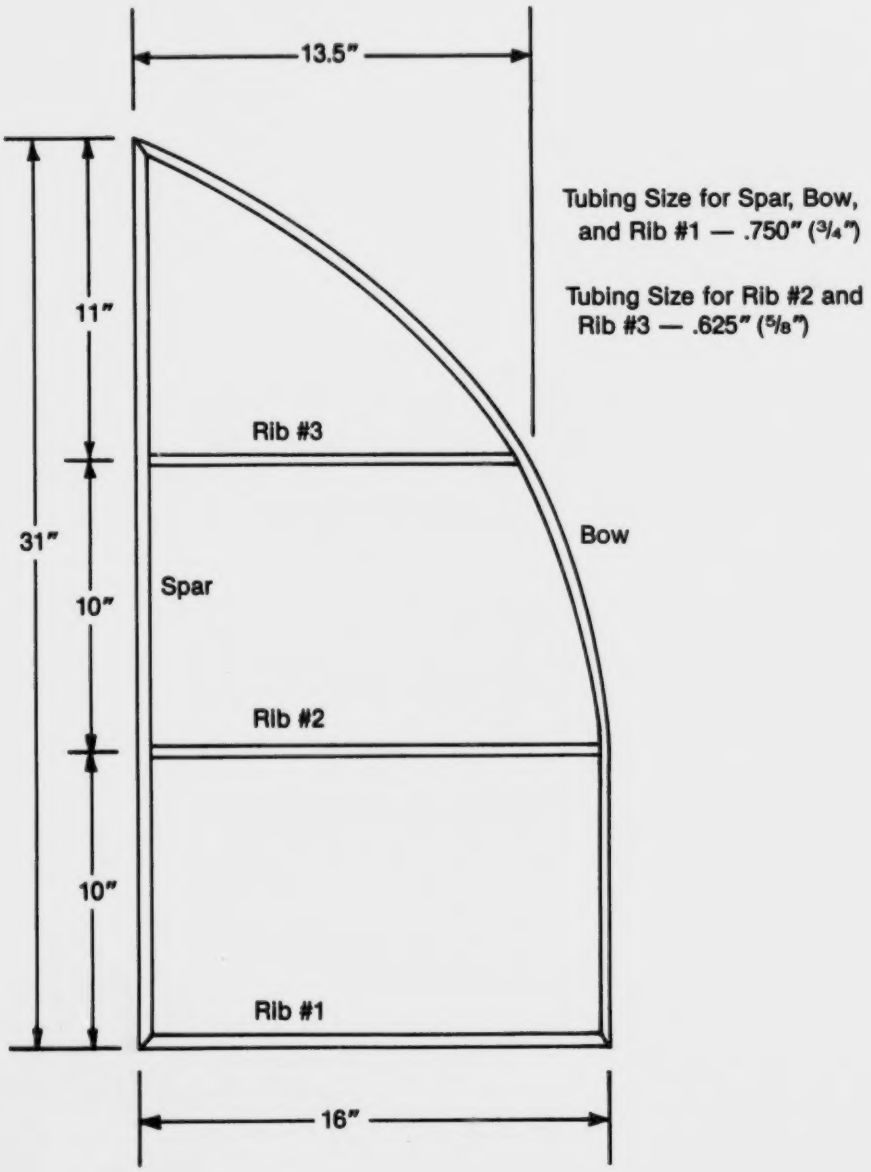
Estimated Teaching Time		Theory	Lab
Objective 1	Using Technical Information Supplement #1, discuss the terms and definitions related to inspecting, testing, installing, and repairing aircraft fabric coverings. Ask the students to briefly search through the text material and locate other terms which are not familiar to them. Define these terms for the class. Have visual examples of as many of the terms as possible. Use Transparency Master #1.		
Objective 2	Name the acceptable data sources for fabric covering installation and repair. Have examples of the various sources of approved data for the class to examine. This would be an ideal time to have students refer to FAR 43, Appendix A, and review the section which defines ***major repair*** and ***major alteration*** relating to fabric covering. Explain how field approval is obtained. Check with the FAA for any materials (booklets, films, etc.) which would pertain to obtaining a field approval.		

Estimated Teaching Time		Theory	Lab
Objective 3	Explain the meaning of *approved materials*. Have materials on hand which look like the correct materials but which are not approved for aircraft use. Show how approved materials are identified by specification code and the letters "FAA-PMA" found on the materials or accompanying documentation.		
Objective 4	Name the three categories of aircraft still using fabric covering materials and processes. Have photographs of fabric-covered aircraft in these categories. Discuss the benefits of using fabric for these areas and the differences in the fabric application processes for these areas. Have students complete EA-ITP-AW 3:II-III:1.		
Objective 5	Explain what is meant by *fabric covering system*. Be sure to have literature on systems which are currently being used in aviation. List some of the materials for each of the systems, and be sure that the class understands the result of substituting materials of one system with those of another. Allow the class to examine any available materials used in the fabric covering system.		
Objective 6	Discuss the reference (cotton and linen) covering system materials and their relevance to the overall process. Be sure to acquaint the class with the basic characteristics of these materials and instances when it is legal to substitute one material for another within the reference system.		
Objective 7	Explain the time intervals, methods, and strength factors used to determine the need to recover a fabric structure. Demonstrate the punch test and the pull test, and explain that these two tests are used to determine fabric strength. Use Transparency Master #2.		

Estimated Teaching Time		Theory	Lab
Objective 8	Explain how to properly remove fabric from an aircraft structure. If possible, let the class examine fabric which has been removed from an aircraft structure. Have them point out where the control cables, strut attach fittings, and other parts of the structure and control systems passed through the cover.		
Objective 9	Explain how to properly inspect the aircraft structure and prepare the structure for recovering. Emphasize to the students that the knowledge and integrity of the technician is the only guarantee that the structure, which will be out of sight for many years after the cover is in place, will continue to withstand the rigors of flight. Have the students complete Workbook Supplement #1.		
Objective 10	Explain the procedures used to install cotton and linen coverings. Demonstrate how to tie the modified seine knot and the splice knot. Use Transparency Masters #3-#6. Show the class a control surface or similar part of a structure which has been covered with cotton. Have the students complete Workbook Supplement #2.		
Objective 11	Discuss the Dacron fabric covering system. Allow the class to examine the *Stits Poly-Fiber Covering & Painting Manual* and *Stits Poly-Fiber Aircraft Coatings*, Catalog #200. Be sure to explain the advantages and disadvantages of using the Dacron covering system.		
Objective 12	Discuss the glass cloth covering system. Have an example of a glass cloth installation for the class to examine. Explain the advantages and disadvantages associated with using this system. Have the students complete EA-ITP-AW 3:IV:2-5.		

Estimated Teaching Time		Theory	Lab
Objectives 13-16	Discuss fabric repairs. Explain how to recognize which type of repair to use for any specific damage. Explain the procedure for repairing L-shaped damage. Explain the procedures for all other types of damage repair. State the required result of a fabric repair. Have examples of fabric repairs for the class to examine. Demonstrate the baseball stitch. Discuss the differences in the ways repairs are accomplished on cotton and on Dacron system coverings. Have the students complete EA-ITP-AW 3:V:5-6 and Workbook Supplement #3. Use Transparency Masters #7-#10. Have students complete EA-ITP-ASG 39-45:1-114 for a comprehensive review.		
Objectives 17-19	Build the frame shown in Instructional Supplement #1 to be used for Project Guides #1-#3. Discuss Project Guides #1-#3 with the class; review all pertinent safety rules and precautions, and demonstrate all procedures. Have students complete the projects. Review the projects in class after all students have completed.		

INSTRUCTIONAL SUPPLEMENT #1 — Diagram for the Rudder Control Surface Frame



TECHNICAL INFORMATION SUPPLEMENT #1 — Terms and Definitions

A. Filling, woof, or weft — Direction across the width of the fabric; threads that run at a right angle to the selvage

B. Warp — Direction along the length of fabric; threads that run parallel to the selvage

C. Warp ends — Woven threads that run the length of the fabric

D. Ply — Number of yarns making up a thread

E. Bias — Cut, fold, or seam made diagonally to the warp or fill threads

F. Count — Number of threads per inch in warp or filling

G. Mercerization — Process of dipping cotton yarn or fabric in a hot solution of diluted caustic soda

(NOTE: This treatment causes the material to shrink and acquire greater strength and luster.)

H. Calendering — Process of ironing fabric by threading it wet between a series of hot and cold rollers to produce a smooth finish

I. Sizing — Material such as starch used to stiffen the yarns for ease in weaving the cloth

J. Pinked edge — Edge which has been cut by machine or shears in a continuous series of Vs to prevent raveling

K. Selvage edge — Lengthwise edge of cloth, tape, or webbing woven to prevent raveling

L. Nap — Short fiber ends which protrude from the surface of a fabric

(NOTE: When the fabric is doped, these fibers become stiff and must be sanded off. This is called laying the nap.)

M. Supplemental Type Certificate (STC) — Certificate authorizing an alteration to an airframe, engine, or component which has been granted an Approved Type Certificate

N. FAA-PMA — Identifying letters required on an aircraft part or component to signify it as being manufactured under a Federal Aviation Administration Parts Manufacturing Approval

O. AC 43.13-1A — Advisory circular in book form issued by the Federal Aviation Administration which covers acceptable methods, techniques, and practices for aircraft inspection and repair

P. Nitrate dope — Finish for aircraft fabric, consisting of a film base of cellulose fibers dissolved in nitric acid, with the necessary plasticizers, thinners, and solvents

Q. Butyrate dope — Finish for aircraft fabric, consisting of a film base of cellulose fibers dissolved in acetic and butyrate acids, with the necessary plasticizers, solvents, and thinners

R. Dacron — Registered trade name for polyester fibers made by the E.I. DuPont de Nemours & Company

S. Acetone — Flammable liquid ketone (C_3H_6O) used as a solvent and a constituent in many aircraft finishes

T. Polyester fiber — Synthetic fiber noted for its mechanical strength, chemical stability, and long life

(NOTE: Polyester fiber is used to make woven fabric for covering aircraft structures.)

U. Poly-Fiber — Registered trade name for a fabric woven from polyester fibers

(NOTE: Eonnex and Ceconite are also registered trade names for fabric woven from polyester fibers. Different application processes are used for these.)

V. Grade-A cotton — Long-staple cotton fabric with 80 threads per inch in both the warp and fill directions

(NOTE: This is the standard material for covering aircraft structures.)

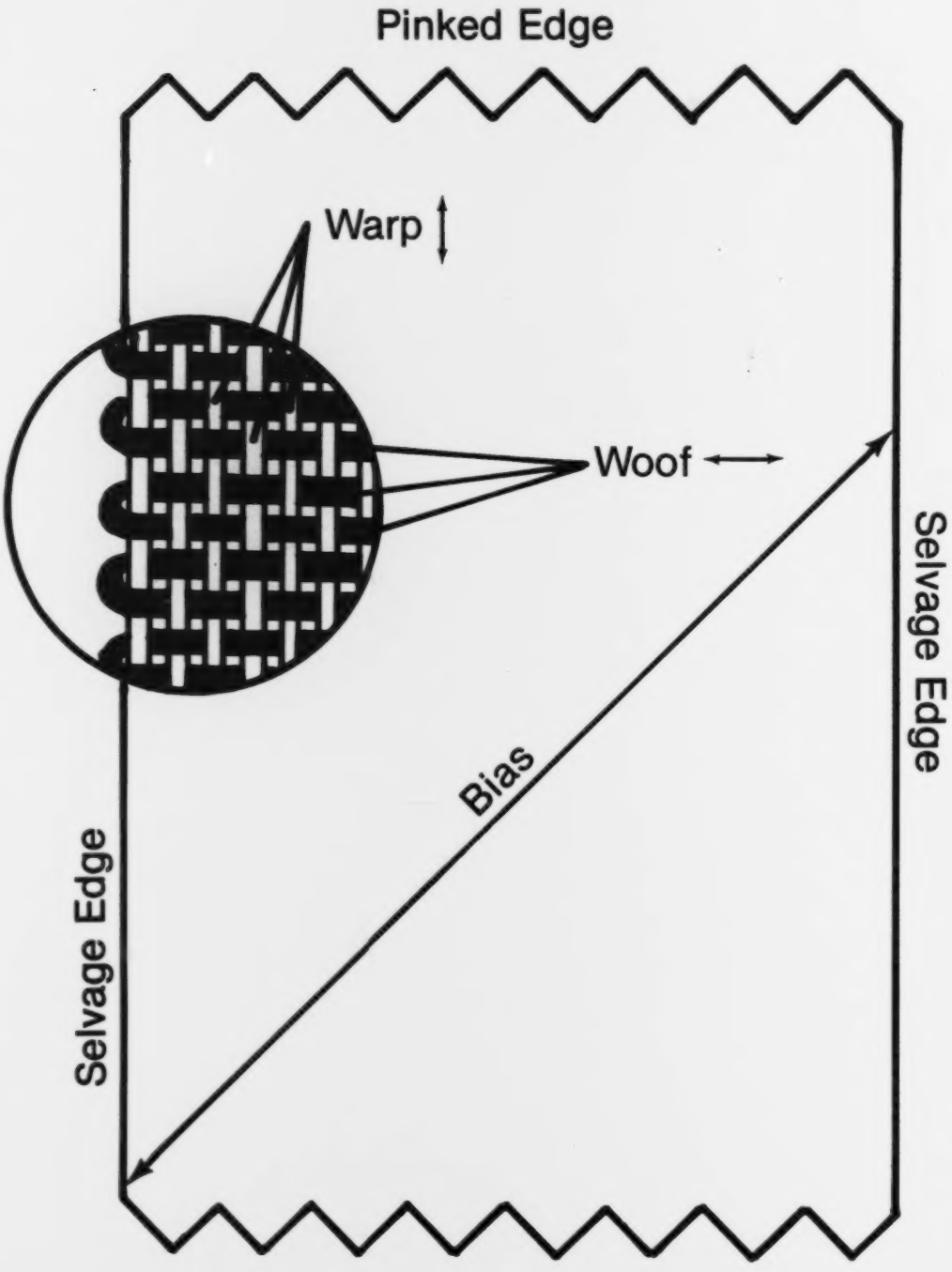
W. Greige Dacron — Synthetic polyester fiber fabric in its unshrunk condition as it comes from the loom

X. Irish linen — Strong fabric made from flax

(NOTE: Irish linen is still popular in Europe but is no longer readily available in the United States. It was used to cover may of the older aircraft. It may be used as a direct replacement for grade-A cotton.)

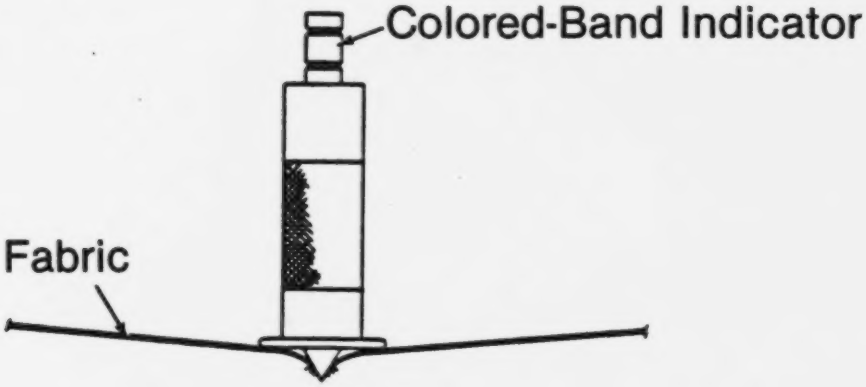
Y. Staple — Textile fiber of relatively short length that when spun and twisted forms a yarn rather than a filament

Fabric Terms

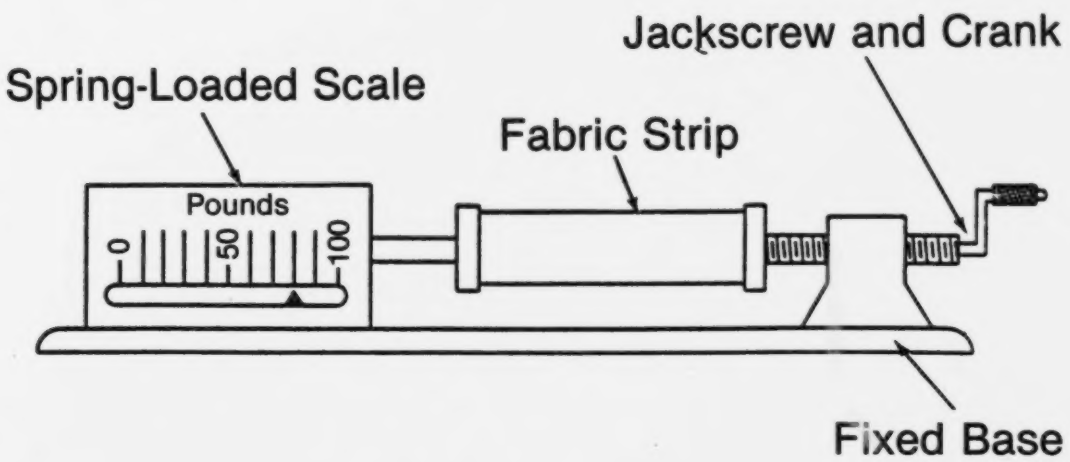


Source: EA-AC 65-15A.

Fabric Testing Tools



Fabric Punch Tester

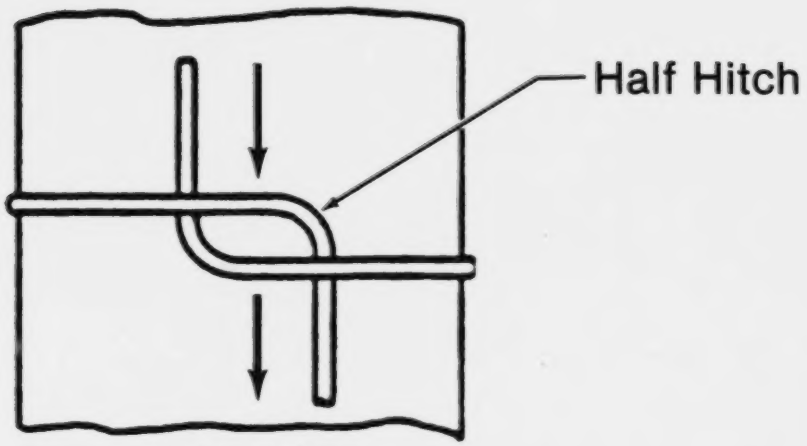


Fabric Tensile Tester

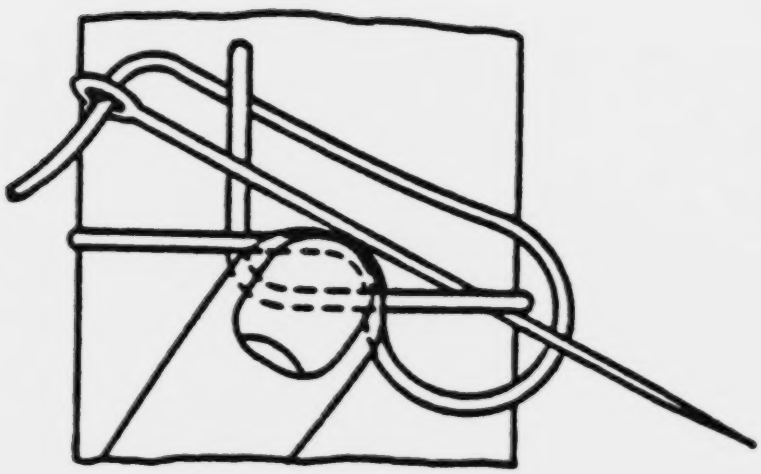
Source: EA-AC 65-15A.

Standard Knot for Rib Lacing

Modified Seine Knot



First Step



Second Step

Source: EA-AC 65-15A.

Standard Knot for Rib Lacing
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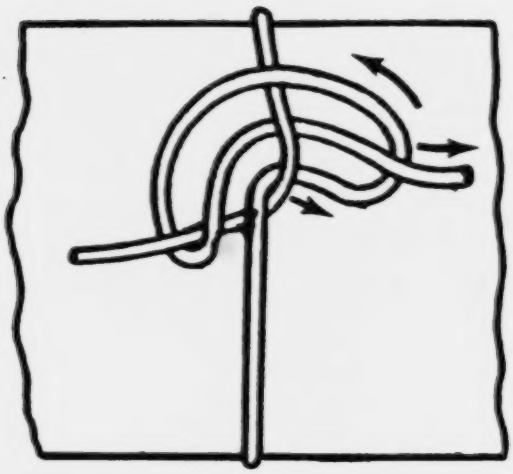
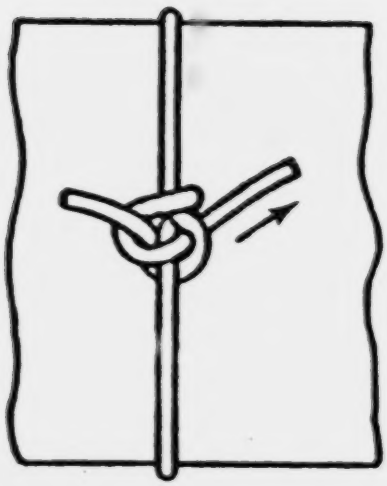


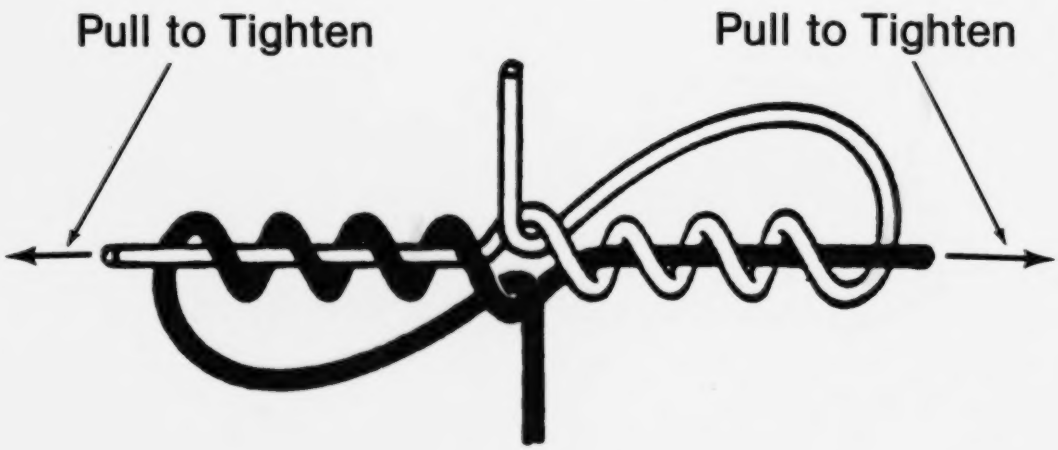
Third Step



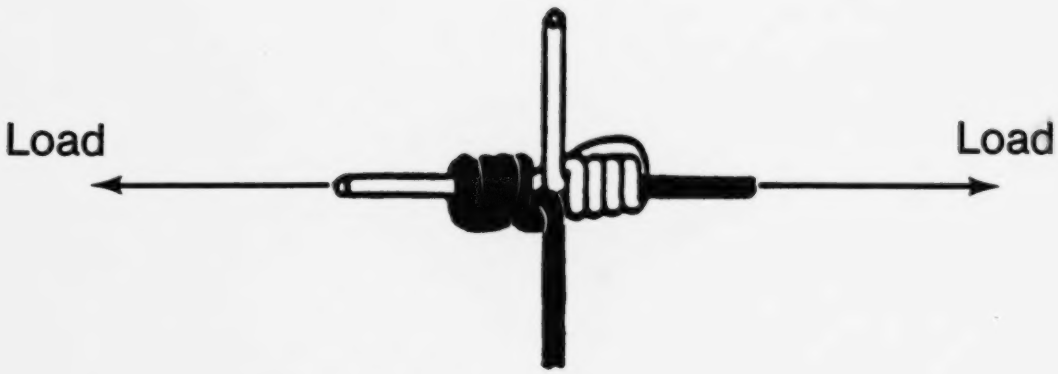
Completed Knot

Source: EA-AC 65-15A.

Splice Knot



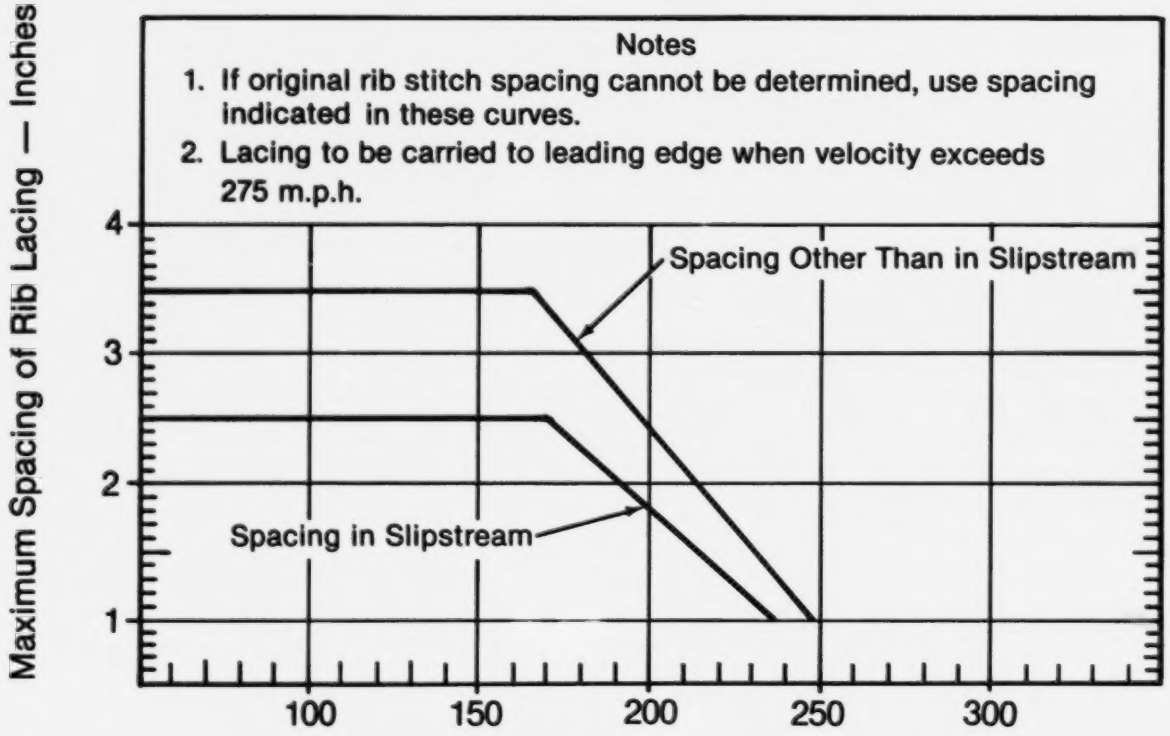
Knot Formed But Not Tightened



Knot Completed

Source: EA-AC 65-15A.

Rib Stitch Spacing Chart



(Curves presume leading edge support reinforcement such as plywood, metal.)

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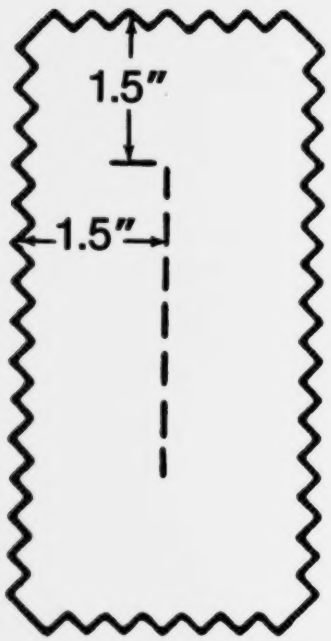
Repair of Fabric Tears



Source: EA-AC 65-15A.

Repair of Fabric Tears
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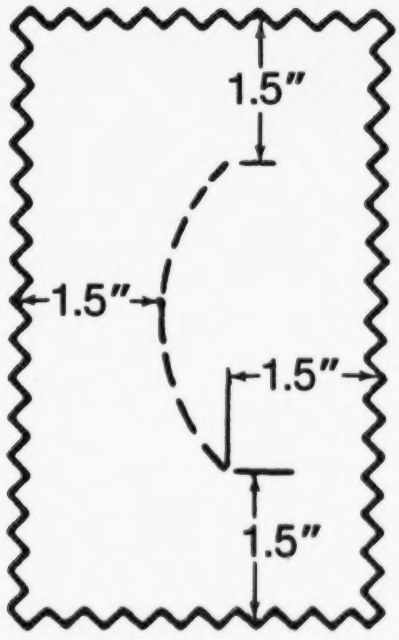

Source: EA-AC 65-15A.

Repair of Fabric Tears
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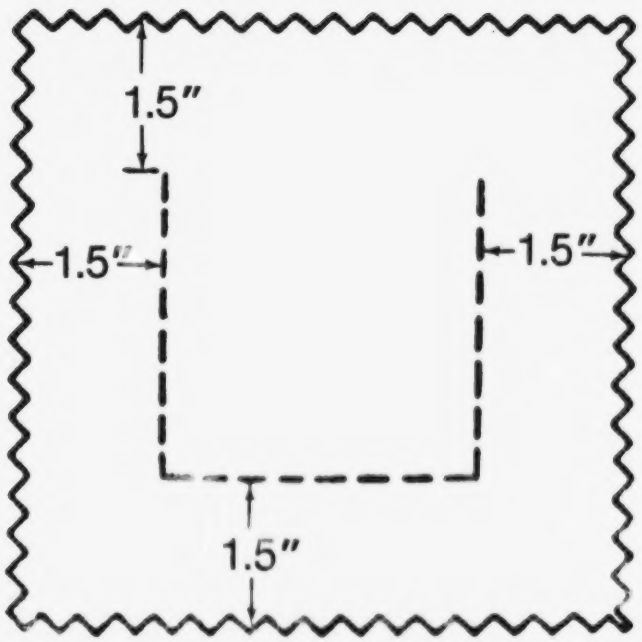
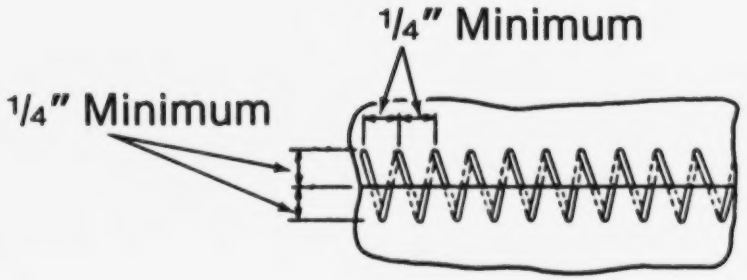
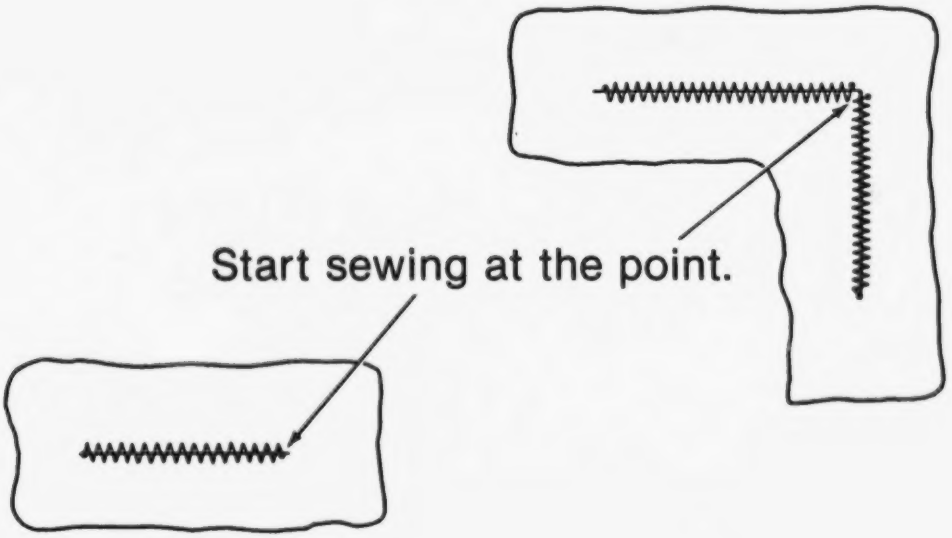


Source: EA-AC 65-15A.

Sewn Fabric Repairs



Baseball Stitch



Lock stitch every 8 or 10 stitches and at ends with modified seine knot.

Source: EA-AC 65-15A.

WORKBOOK SUPPLEMENT #1 — Interpret Information Related to Inspection, Testing, and Installation of Aircraft Fabric Covering

One aspect of the recovering task which cannot be emphasized enough is the inspection and preparation of the aircraft structure for recovering. The aviation maintenance technician must use accepted methods when inspecting the aircraft's fabric covering to ensure that damage does not occur as a result of the inspection and that the outcome of the inspection is truly indicative of the fabric's condition. The technician must also select materials which conform to the manufacturer's specifications for the aircraft to retain its airworthy status. This procedure must be performed conscientiously and thoroughly because the structure will be concealed by the fabric covering for many years.

This workbook supplement will help you to gain the knowledge necessary for you to attain the highest levels of professionalism required for this unique skill.

A. Select from the following list the statements that are true in relation to how approved materials are recognized by the maintenance technician. Write an "X" in the blanks before the correct answers.

_____1. Any fabric material made of cotton can be substituted for grade-A cotton as long as the color of the materials is the same

_____2. It is the responsibility of the owner of the aircraft to make sure that all materials used in repairing the fabric covering of the aircraft meet the specification requirements for certification of the aircraft

_____3. Buy only the best-quality, approved materials from a reputable aircraft supply dealer when restoring an aircraft's fabric cover

_____4. If a material to be used in the recovering process has the specification number and the letters "FAA-PMA" stamped on it, it has met the appropriate specification guidelines

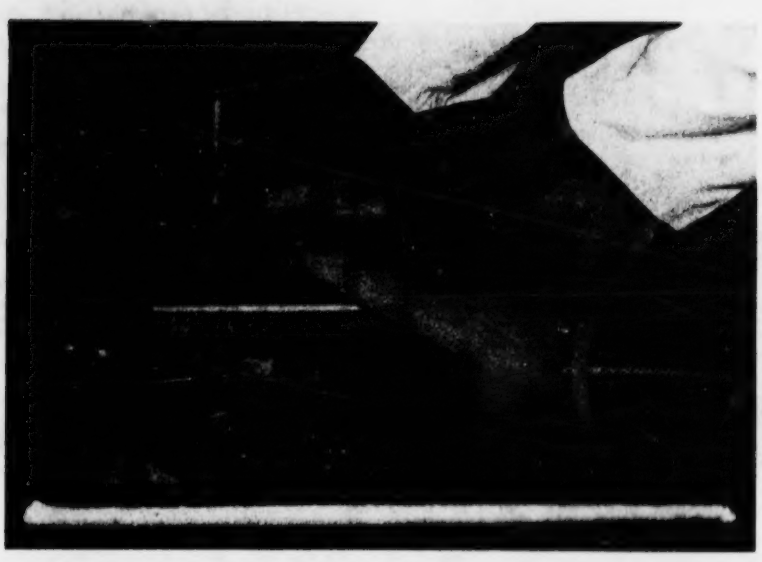
_____5. If you install unapproved materials on an aircraft, you are in violation of the Federal Aviation Regulations

B. Answer the following questions related to inspecting and testing aircraft fabric covering.

1. How often must the condition of a fabric covering be determined?

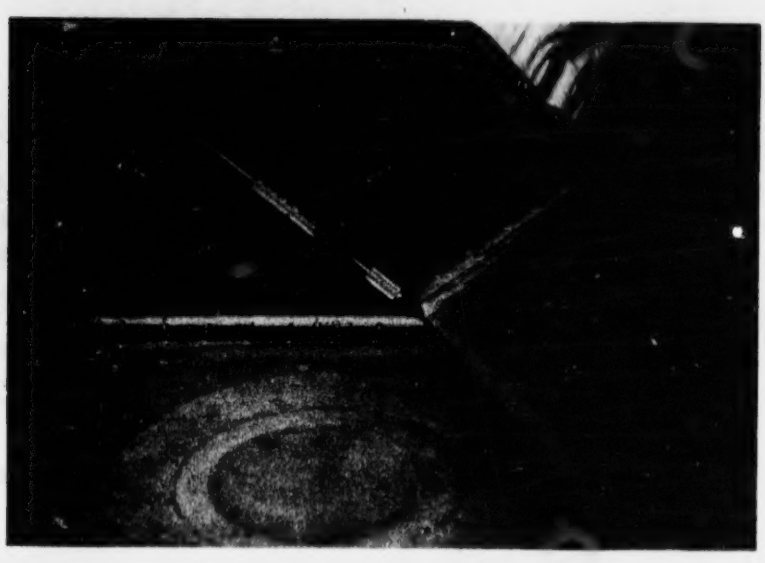
_____

FIGURE 1



2. Cut any rib lacing in a progressive manner from bow to spar (Figure 2)

FIGURE 2



2. When is a fabric considered to be unairworthy?

_____

_____

3. When the punch test is being performed on a fabric covering, what is indicated when only the red band shows on a fabric punch tester?

_____

4. What should be done if the fabric fails the punch test?

_____

5. On which area of an aircraft is fabric most likely to suffer the most deterioration over a period of time?

_____

_____

C. Select statements related to fabric removal, inspection, and preparation of the aircraft structure for covering. Circle the letters before the correct answers.

1. When it is determined by a pull test that the fabric must be replaced, disassemble the aircraft and prepare it for recovering. This procedure should be accomplished in accordance with steps listed in the

   a. local repair station's policies

   b. *Aircraft Fabric Covering Tips*

   c. fabric manufacturer's procedures manual

   d. aircraft manufacturer's service manual

2. The best policy to use when removing the fabric from an aircraft structure is

   a. remove all the fabric covering at once so that no part of the structure is left covered

   b. throw away the old cover as soon as it is removed from the aircraft to prevent the shop from accumulating litter

   c. uncover each major component only when you are ready to work on it, and retain the old cover until the job is done to refer to for stitch location, inspection openings, and to locate holes for control cables

3. The most critical area of the truss tubing fuselage in relation to corrosion is

   a. the highest portion of the vertical stabilizer

   b. the lowest portion of the fuselage

   c. the horizontal members of the truss

4. Wooden formers or stringers should be coated with a good

   a. thick grease

   b. neutral solvent

   c. clear spar varnish

   d. enamel paint

5. Metal components of the structure should be covered with

   a. epoxy primer

   b. lightweight oil

   c. clear spar varnish

   d. brown grease

WORKBOOK SUPPLEMENT #2 — Discuss the Cotton and Linen Aircraft Covering System

The cotton and linen (reference) system is the oldest covering system known to aviation. There are many aircraft flying today which still employ this reference system. The aircraft maintenance technician who thoroughly learns this system will have acquired knowledge which can be used to analyze and implement any other alternative system.

This workbook supplement will help you to apply knowledge in relation to the actual covering of an aircraft with cotton or linen fabric. Answer the following questions in the blanks provided.

A. When should the aircraft component which is being recovered be grounded?

_____

_____

_____

B. How many coats of finishing material should be applied when finishing a fabric-covered surface?

_____

_____

_____

C. How do you determine whether a fabric surface has been finished with nitrate (cellulose nitrate) or with butyrate (cellulose acetate butyrate) dope?

_____

_____

_____

D. What is the chief purpose of pigment (or aluminum) in dope?

_____

E. Why are fabric coverings laced to the wing structure?

_____

_____

F. How are the lacings secured to the structure?

_____

G. Where are the seine knots positioned after they are tied?

_____

_____

H. When and how is finishing tape installed on fabric-covered surfaces?

_____

_____

I. Why is surface or finishing tape installed on fabric-covered surfaces?

_____

_____

J. Why is surface tape notched at intervals before it is applied to the trailing edge of a wing or control surface?

_____

_____

WORKBOOK SUPPLEMENT #3 — Discuss Fabric Repairs

The repair of the fabric covering found on aircraft fuselages, wings, stabilizers, and control surfaces must be accomplished in accordance with approved data. Aviation maintenance technicians must use their knowledge and skill in a competent manner to return aircraft coverings to their original strength and tautness.

This workbook supplement will give you the opportunity to demonstrate your knowledge of fabric repair processes.

A. Answer the following questions related to fabric repairs.

1. What is the best method to repair a fabric-covered surface which has an L-shaped tear, each leg of which is approximately 14 inches long?

_____

_____

_____

2. In addition to the manufacturer's service manual, where would a technician look to find acceptable methods for repairing fabric coverings?

_____

3. What is the expected result of a fabric repair?

_____

_____

4. How is damage which exceeds 16 inches in any one direction repaired?

_____

5. What type of stitch is used for sewing a repair on aircraft fabric?

_____

6. What is the recommended procedure for preparing a surface for a doped-on fabric patch?

_____

_____

7. When performing a doped-in panel repair, how far should the new fabric extend beyond the ribs which border the repair?

_____

B. State the criteria used to determine when to use the following specific repairs on a damaged fabric covering.

1. Doped-on patch

_____

_____

_____

_____

2. Sewn-in patch

_____

_____

_____

_____

3. Doped-in panel

_____

_____

C. List in order the steps for accomplishing an L-shaped repair on fabric damage. Assume the fabric has been finished with dope.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

ANSWERS TO WORKBOOK SUPPLEMENTS

Workbook Supplement #1

A. 3, 4, 5

B. 1. At every 100-hour and annual inspection
2. When it deteriorates to less than 70 percent of the strength of the same fabric when new
3. The fabric is weak
4. Perform the pull test
5. The top of the wing or fuselage, especially in an area that is painted with a dark finish

C. 1. d
2. c
3. b
4. c
5. a

Workbook Supplement #2

A. Whenever operations involving sanding, rubbing, or wiping of detached fabric-covered wings are to be performed
B. At least the number of coats necessary to result in a taut and well-filled finish job
C. Rub a small section with lacquer thinner; butyrate finish will not be affected, but nitrate finish will be softened
D. To exclude sunlight from the fabric
E. To maintain the contour of the airfoil and to prevent lifting and whipping of the fabric in flight
F. By the use of seine knots
G. In the middle of, or along the edge of, the bottom cap strip
H. It should be doped on after the first or second coat of dope
I. To prevent wear over lacings, seams, corners, and edges
J. To prevent the entire tape from loosening in the event the tape begins to separate from the surface

Workbook Supplement #3

A. 1. Sew with a baseball stitch from the center of the tear out toward the extremity of each leg, and then dope on a patch
2. AC 43.13-1A&2A
3. The repair should return the original strength and tautness to the fabric
4. By a doped-in panel

5. Baseball stitch
6. Clean and remove all aluminum and color coats from the surface to which the patch is to be doped
7. Three inches

B. 1. Use when the damage to a fabric-covered structure does not extend more than 16 inches in any direction and the aircraft has a never-exceed speed of 150 miles per hour or less
2. Use when the damage does not exceed 16 inches in any direction and the aircraft has a never-exceed speed of more than 150 miles per hour
3. Use when the damage exceeds more than 16 inches in any one direction

C. 1. Sew the tear beginning at the apex of the tear and working outward using a baseball stitch
2. Brush some butyrate dope around the tear, and allow it to soften the finish
3. Use a dull knife to scrape away the dope after it softens
4. Remove the dope down to the clear coats for a distance of at least 1½ inches from the tear
5. Cut the patch with pinking shears
6. Brush a coat of dope over the cleaned-out area
7. Lay the patch in place
8. Apply a good, solid coat of dope to the patch, and allow to dry
9. Sand to remove the nap of the fabric
10. Apply additional coats of dope to return repaired area to original smoothness
11. Finish repaired area in manner similar to the rest of the covering

PROJECT GUIDE #1 — Inspect and Test Aircraft Fabric Covering

PURPOSE: To allow you to develop the skills related to visually inspecting, punch testing, and pull testing aircraft fabric.

REFERENCE MANUALS:

A. EA-ITP-AB

B. AC 65-15A

C. AC 43.13-1A&2A

EQUIPMENT AND TOOLS:

A. Unairworthy grade-A cotton-fabric-covered wing

B. Dacron-fabric-covered panel

C. Hefner Model 10 (or similar) fabric pull tester

D. Seyboth punch tester (grade-A cotton type)

E. Maule punch tester

F. Razor knife

SUPPLIES AND MATERIALS: 1/2-inch masking tape

PROCEDURE:

A. Inspect and test Dacron-fabric-covered panel

1. Visually inspect Dacron-fabric-covered panel, and record condition of finish, fabric, stitching, surface tapes, and seams

Finish — _____

Fabric — _____

Stitching — _____

Surface tapes — _____

Seams — _____

2. Cut a 1" x 3" piece of cloth from Dacron-fabric-covered panel using razor knife

3. Using Hefner Model 10 (or similar) pull tester, perform pull test on piece of cloth

4. Record results of pull test

   Pull test on Dacron fabric — _____

   _____

B. Inspect and test fabric-covered wing

1. Using Seyboth punch tester and tester instructions, punch test cotton-fabric-covered wing

2. Using Maule punch tester and tester instructions, punch test cotton-fabric-covered wing

3. Record results of punch tests

   Seyboth punch test — _____

   _____

   Maule punch test — _____

   _____

4. Tape over any damage created by punch testing with 1" x 1/2" piece of masking tape

   (NOTE: This is done to prevent a punch test from being performed at a location where one was previously performed. This is not done on an actual repair.)

C. Clean work area, and return tools and equipment to proper storage area

PROJECT GUIDE #2 — Install Aircraft Fabric Covering

PURPOSE: To allow you to develop skill in the installation processes related to fabric covering. These processes will include removal of old fabric, preparation and inspection of the structure prior to recovering, and the actual recovering procedures.

REFERENCE MANUAL: *Stits Poly-Fiber Covering & Painting Manual*

EQUIPMENT AND TOOLS:

A. Razor knife

B. Iron, 1100 watts minimum

C. Candy thermometer

D. Fabric-covered control surface frame

E. Pinking shears

F. Straight-cut shears

G. Pencil-tip soldering iron

H. Curved-tip needle

I. Appropriate personal safety devices and protective clothing

SUPPLIES AND MATERIALS:

A. 2-inch polyester tapered-bristle brush

B. 1/2-inch acid brush

C. D-103 Stits cloth

D. 2-inch finishing tape

E. 3-inch standard finishing tape

F. 3-inch bias-cut finishing tape

G. Rib lacing cord

H. Poly-Tak

I. MEK

J. Poly-Brush

K. Poly-Fiber Reducer

L. Blush retarder

M. Shop rags

N. 1/2-inch reinforcing tape

O. Inspection hole reinforcement rings

P. Aluminum drain grommets

Q. Paint strainer cones (60 x 48 or finer mesh)

R. Anti-chafe tape

S. Masking tape

T. Tack rag

U. 12" x 12" piece of cardboard

V. Paint stir paddles

W. Silicone heat sink compound

X. Paper towels

Y. Soup ladles (to transfer and measure coatings)

Z. Small glass containers or baby-food jars

AA. No. 2 pencil

BB. 12-inch ruler

PROCEDURE:

A. Remove old fabric

1. Cut fabric along contour of bow a small distance from tubing and peel fabric toward spar (See Figure 1)

CAUTION

Do not cut fabric which is directly on top of metal or wood structure.

3. Peel fabric from around spar and back to and off bow (Figure 3)

   (NOTE: If the fabric does not easily peel off the structure, use Poly-Fiber Reducer to reduce glue adhesion.)

FIGURE 3

B. Clean frame with rag wetted with MEK

WARNING

Avoid breathing MEK vapors. Use mechanical ventilation or respiratory protection when working in confined space or area. Avoid contact with skin, eyes, and clothing. Never use MEK or any solvent to clean hands. Wear eye protection. Keep away from sources of heat, fire, or sparks. Breathing vapors or allowing solvent to contact skin or eyes is hazardous. Heat, fire, or sparks can cause an explosion.

C. Visually inspect frame, and record condition of welds and external condition of frame

Welds — _____

_____

External condition — _____

_____

(NOTE: The fabric-covering process normally requires that the frame be grit-blasted and primed at this point. This step has been omitted in this project guide because of the number of times the frame will be recovered. The covering of an airworthy structure *always* requires that a proper metal primer be used on the frame.)

D. Mix equal parts of Poly-Brush and Poly-Fiber Reducer in sufficient amounts to apply two coats to area of frame where fabric will contact frame

(NOTE: Baby-food jars serve well as containers for this mix.)

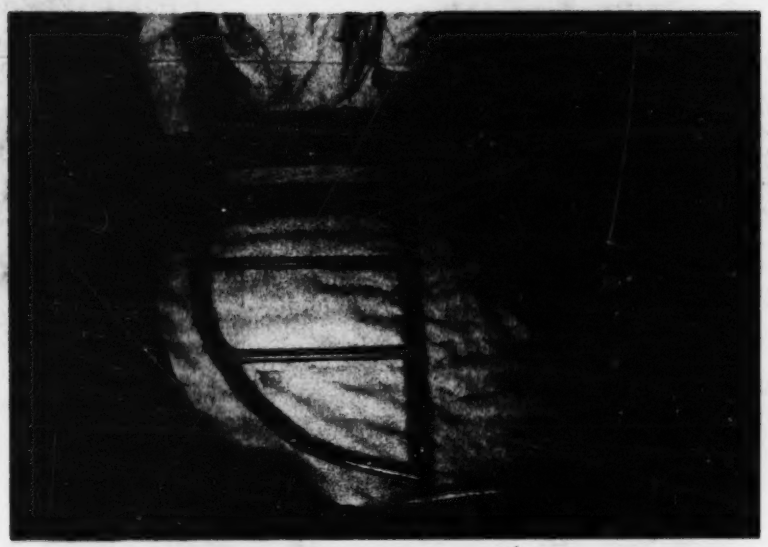
E. Apply Poly-Brush/Poly-Fiber Reducer mix using 2-inch polyester tapered-bristle brush to areas of control surface frame where fabric will contact (Figure 4)

FIGURE 4

F. Using straight-cut shears, cut a piece of cloth from shop supply large enough to wrap completely around frame with approximately two- to three-finger-widths overlap on both sides along bow and rib #1 (See Figure 5)

(NOTE: The two- to three-finger-widths overlap will normally allow enough material for the one side of the fabric cover to wrap approximately three-fourths of the distance around the circumference of the tubing and the other side of the fabric to overlap by a minimum of one inch. See Figure 5.)

FIGURE 5



G. Apply anti-chafe tape on any sharp areas of frame (Figure 6)

FIGURE 6

H. Wrap fabric around frame, positioning frame so that bow protrudes slightly over edge of workbench (See Figure 7)

(NOTE: The fabric which is under the frame will be allowed to hang down, exposing the metal surface of the tubing which is facing down.)

I. Fold upper portion of fabric covering out of the way (Figure 7)

FIGURE 7

J. Place small amount of Poly-Tak in glass jar, and thin with MEK as required to achieve proper viscosity

WARNING

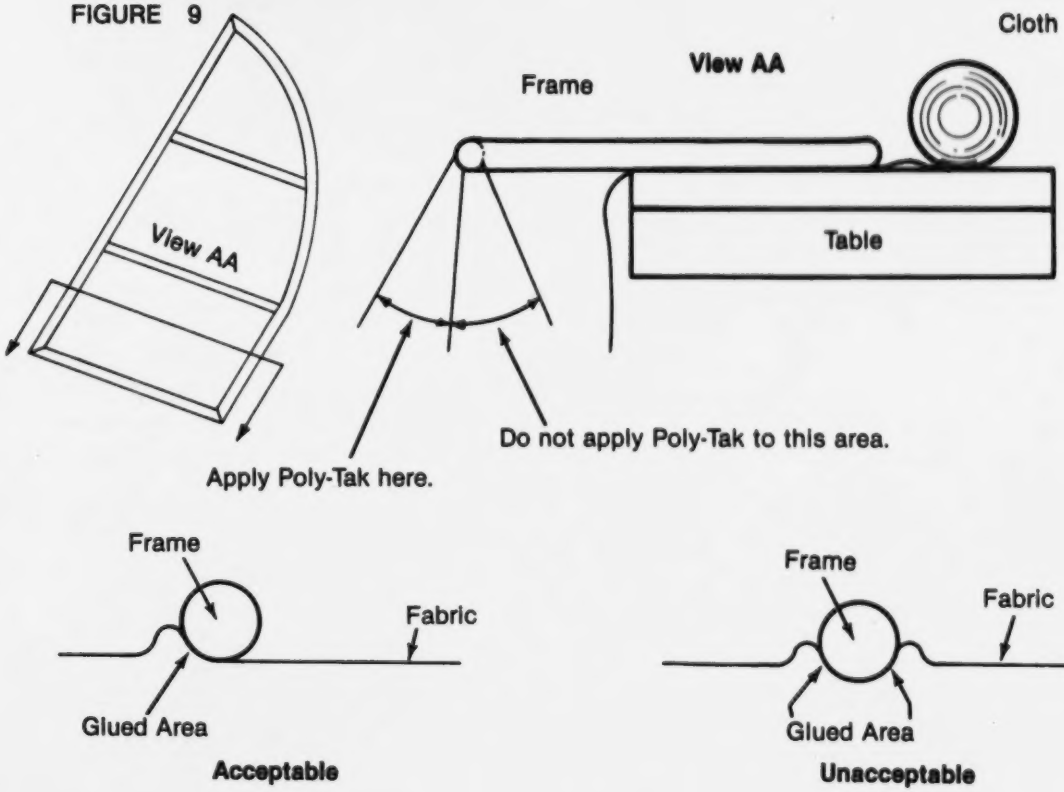
Avoid breathing MEK vapors. Use mechanical ventilation or respiratory protection when working in confined space or area. Avoid contact with skin, eyes, and clothing. Never use MEK or any solvent to clean hands. Wear eye protection. Keep away from sources of heat, fire, or sparks. Breathing vapors or allowing solvent to contact skin or eyes is hazardous. Heat, fire, or sparks can cause an explosion.

K. Using acid brush, lay small bead of Poly-Tak approximately 6 inches long along bow on side of frame facing down on area of tubing shown in Figure 8

(NOTE: Be careful not to allow the Poly-Tak to travel around the tubing to the inside of the frame. This will cause the fabric to adhere to the frame at a higher point on the tubing than is desirable. See Figures 8 and 9.)

FIGURE 8

FIGURE 9



L. Lift fabric which is hanging underneath frame up to area of frame with bead of glue, and work glue through fabric using fingertips; hold fabric in place until Poly-Tak dries (Figure 10)

(NOTE: The gluing procedure used in Steps K and L will be used as a standard gluing procedure in this project guide.)

FIGURE 10

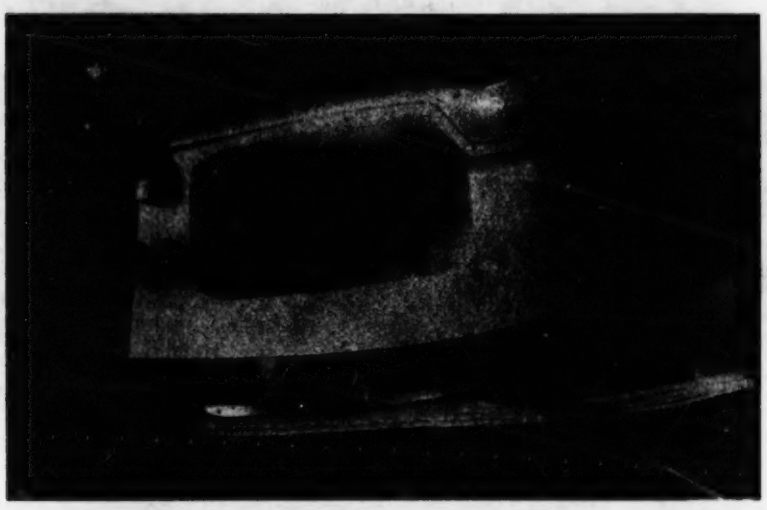
M. Continue applying glue in manner described in Steps K-L until fabric is glued to length of bow

N. Allow glue approximately 15 minutes to properly set up

O. Calibrate iron to be used in heat-tauting procedure according to *Stits Poly-Fiber Covering & Painting Manual*, page 13, Step 3, "Heat Tauting Polyester Fabric" (See Figure 11)

(NOTE: This is a key step in the process, so be sure to comply with all requirements in the *Stits Poly-Fiber Covering & Painting Manual*. It will be necessary to calibrate the iron only once.)

FIGURE 11



P. Set iron to 250°F or as prescribed by *Stits Poly-Fiber Covering & Painting Manual* for initial shrinking of Stits cloth

Q. Shrink excess fabric along bow using iron and cardboard back-up sheet (Figure 12)

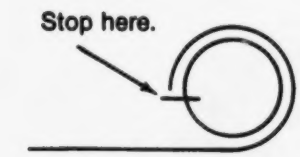
CAUTION

Do not allow the iron to pass over the area where the fabric is glued to the frame.

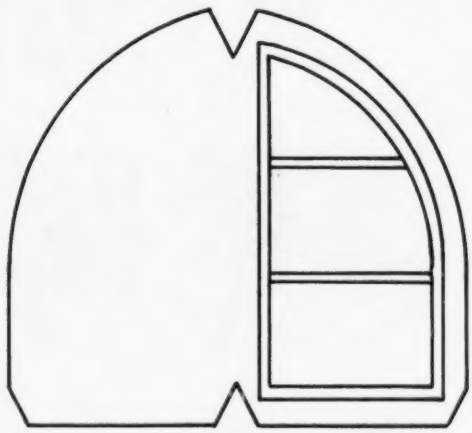
FIGURE 12

R. Trim fabric as necessary to obtain proper amount of cloth to secure around tubing (Figure 13)

FIGURE 13



First piece of fabric glued to frame must terminate approximately at arrow.



Cut corners as required to obtain proper fit.

S. Glue the remaining portion of fabric end to frame using standard gluing procedure

(NOTE: The only difference in the gluing process of this step from the previous gluing steps is that you will spread enough glue on the frame to cover a section of tubing 6 to 10 inches long, and wide enough to fasten the entire remaining portion of the fabric end. Continue this process along the entire length of the bow.)

T. Allow Poly-Tak to dry thoroughly, and then level glued surface with iron set to 200°F or as prescribed by *Stits Poly-Fiber Covering & Painting Manual* (Figure 14)

FIGURE 14

U. Glue end of fabric beneath frame to rib #1 using standard gluing procedures

V. Allow glue along rib approximately 15 minutes to set up

W. Lay small bead of Poly-Tak along center of leading edge of spar (Figure 15)

FIGURE 15

X. Wrap cloth back around spar and pull, using very light tension, back to bow; work glue into fabric with fingertips, and allow glue to dry (Figure 16)

FIGURE 16

Y. Turn frame over, and attach fabric end to bow using standard gluing procedure

(NOTE: A minimum of at least one inch overlap between the two fabric ends must exist for the seam to be airworthy.)

Z. Attach fabric end to rib #1 using standard gluing procedure

AA. Smooth and level any roughness on cemented seams using iron set at 225°F or as prescribed by *Stits Poly-Fiber Covering & Painting Manual* (Figure 17)

FIGURE 17

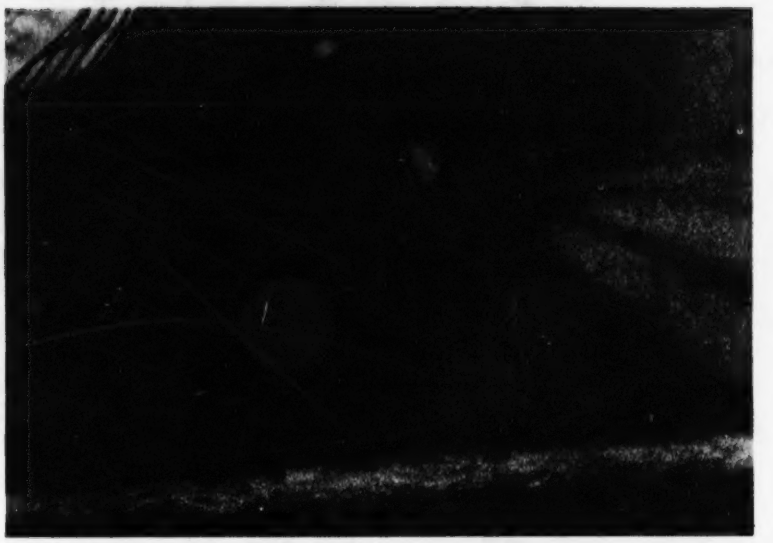
BB. Heat taut all fabric on frame with iron set to 250°F, ironing fabric in strict accordance with *Stits Poly-Fiber Covering & Painting Manual*, page 13, Step 3, "Heat Tauting Polyester Fabric" (See Figure 18)

(NOTE: This is called the initial shrinking.)

CAUTION

Do not allow iron to pass over glued areas.

FIGURE 18



CC. Heat taut fabric with iron set to 350°F, ironing in accordance with *Stits Poly-Fiber Coating & Painting Manual*, page 13, Step 3

(NOTE: This is the final shrinking.)

CAUTION

Do not allow iron to pass over glued areas.

DD. Wipe control surface with tack rag to remove dust and lint

EE. Filter Poly-Brush through 60 × 48 or finer mesh paint strainer cone to remove atmospheric lint particles

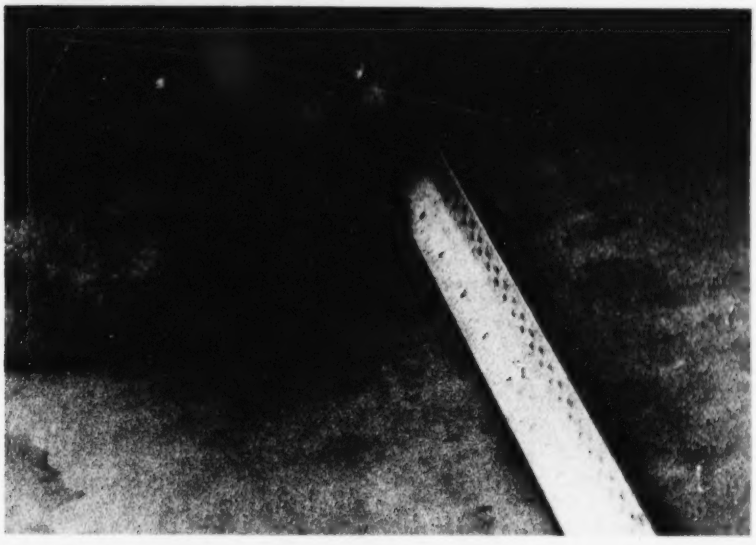
FF. Using 2-inch polyester tapered-bristle brush, apply first coat of Poly-Brush according to *Stits Poly-Fiber Coating & Painting Manual*, page 13, Step 4, "Poly-Brush Application — First Coat"

(NOTE: The first coat must close the fabric porosity to avoid pinholes. This step is best accomplished with the control surface in a vertical position to avoid drip-through.)

GG. Allow Poly-Brush to dry

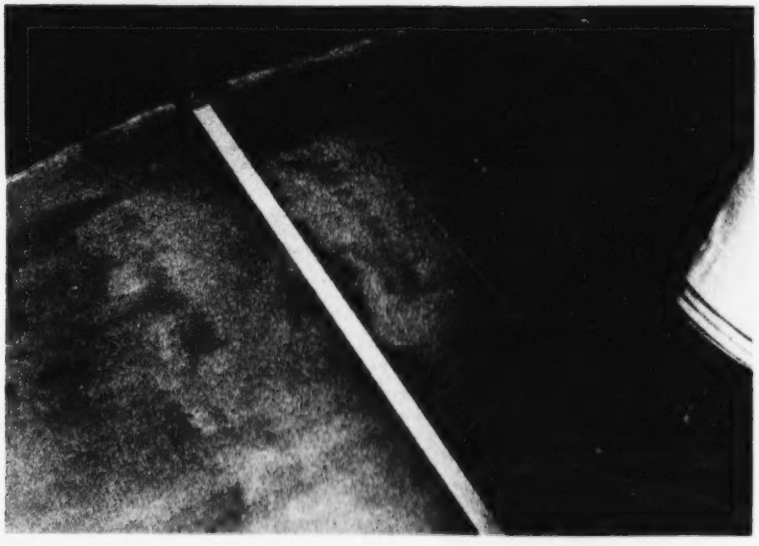
HH. Lay out rib lace spacing using pencil and ruler in accordance with *Stits Poly-Fiber Covering & Painting Manual*, page 14, Fig. 10 (Figure 19)

FIGURE 19



II. Apply reinforcing tape over rib #2 and rib #3 (Figure 20)

FIGURE 20



JJ. Lace rib #2 and rib #3 using curved-tip needle and rib lacing cord

(NOTE: Use procedures depicted on pages 14-16 of the *Stits Poly-Fiber Covering & Painting Manual* to complete this step. Use the same instructions to tie the modified seine knot, hidden square knot, and any other knot used in this procedure.)

KK. Lay out position of inspection access hole reinforcement ring between rib #1 and rib #2

LL. Install access hole reinforcement ring using Poly-Tak (Figure 21)

FIGURE 21

MM. Using pinking shears, cut circular patch from the same cloth used to cover control surface

(NOTE: This patch should overlap with the fabric surface a minimum of one inch beyond the access hole reinforcement ring.)

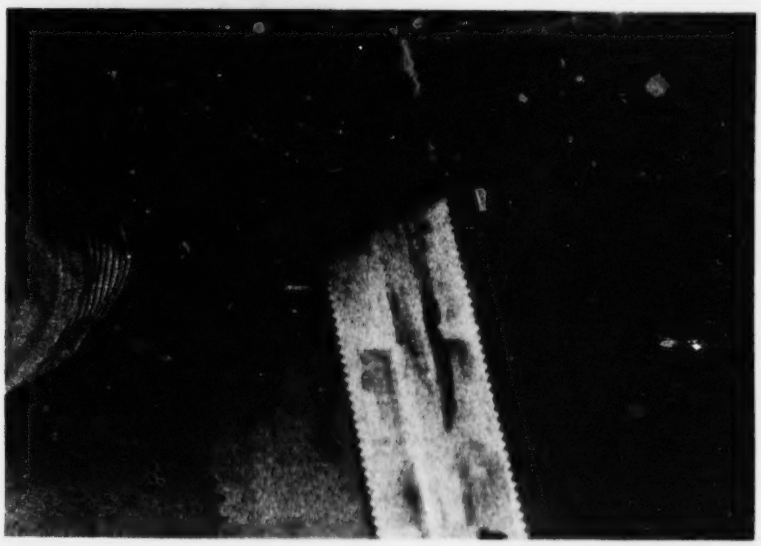
NN.Install patch using Poly-Brush (Figure 22)

FIGURE 22

OO.Remove creases from edges of patch with iron set to 225°F or as prescribed by *Stits Poly-Fiber Covering & Painting Manual*

PP. Apply 2-inch finishing tape over rib lacing with Poly-Brush (Figure 23)

FIGURE 23

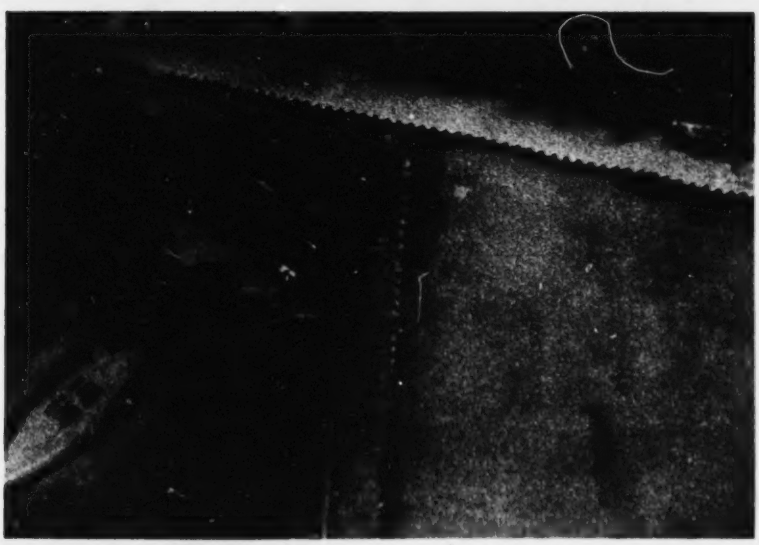


QQ. Apply 3-inch bias-cut finishing tape on bow with Poly-Brush (Figure 24)

FIGURE 24

RR. Apply 3-inch straight-cut finishing tape on rib #1 and spar (Figure 25)

FIGURE 25

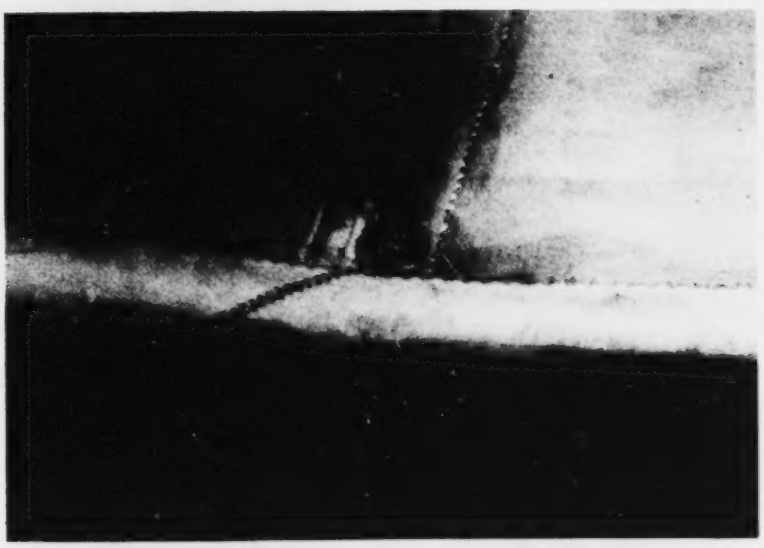


SS. Install drain grommet between rib #2 and rib #3 in lower corner of control surface using Poly-Tak (Figure 26)

FIGURE 26

TT. Burn out material in center of drain grommet using pencil-tip soldering iron (Figure 27)

FIGURE 27



UU. Using 2-inch polyester tapered-bristle brush, apply second coat of Poly-Brush on control surface following procedures outlined in *Stits Poly-Fiber Covering & Painting Manual*, page 18, Step 9, "Second Coat of Poly-Brush"

VV. Allow a minimum of 15 minutes for Poly-Brush to dry

WW. Inspect all tape and reinforcing patch edges for loose edges

XX. Bond loose edges and remove any wrinkles using iron set at 225°F

YY. Clean work area, and return tools and equipment to proper storage area

Procedure in this project guide adapted with permission of Stits Aircraft, from *Stits Poly-Fiber Covering & Painting Manual*, Procedure Manual No. 1, rev. 13, Jan, 1983, 2nd ed., by Ray Stits.

PROJECT GUIDE #3 — Repair Aircraft Covering Using a Doped-On Patch

PURPOSE: To allow you to develop skill in making a simple repair (doped-on patch) to a fabric cover.

REFERENCE MANUAL: *Stits Poly-Fiber Covering & Painting Manual*

EQUIPMENT AND TOOLS:

A. Fabric-covered control surface frame

B. Pinking shears

C. Measuring tape

D. Iron, 1100 watts minimum

E. Razor knife

F. Straight-cut shears

G. Appropriate personal safety devices and protective clothing

SUPPLIES AND MATERIALS:

A. Poly-Tak

B. C-2210 paint surface cleaner

C. 12" x 12" piece of cardboard

D. Clean shop rags

E. 2-inch standard finishing tape

F. Poly-Brush

G. 2-inch polyester tapered-bristle brush

H. 1/2-inch acid brush

I. D-103 Stits cloth

J. 280-grit wet or dry sandpaper

K. Masking tape

L. Masking paper

M. Tack rag

PROCEDURE:

A. Trim damaged area to uniform round, square, or rectangular shape using razor knife and straight-cut shears (Figure 28)

FIGURE 28

B. Fold to inside 1/4 inch of edges of cutout area (Figure 29)

(NOTE: This will prevent a sharp interface line from showing around the edge.)

FIGURE 29

C. Mask area adjacent to repair with masking paper and masking tape (Figure 30)

(NOTE: This will prevent damage to this area during the repair process.)

FIGURE 30

D. Lightly sand Poly-Brush surface using 280-grit wet or dry sandpaper

(NOTE: This is done to clean the surface. The surface being repaired would normally be finished with Poly-Tone or Aero-Thane finish, and it is quite possible that there would be an accumulation of dirt on the fabric surface. Remember, if the damage were over 8 inches in diameter, the Poly-Tone or Aero-Thane finish would have to be removed.)

E. Clean sanding residue from surface with clean shop rag

F. Wipe surface with clean shop rag dampened with C-2210 paint surface cleaner

G. Use pinking shears to cut a rectangular or square patch from D-103 Stits cloth

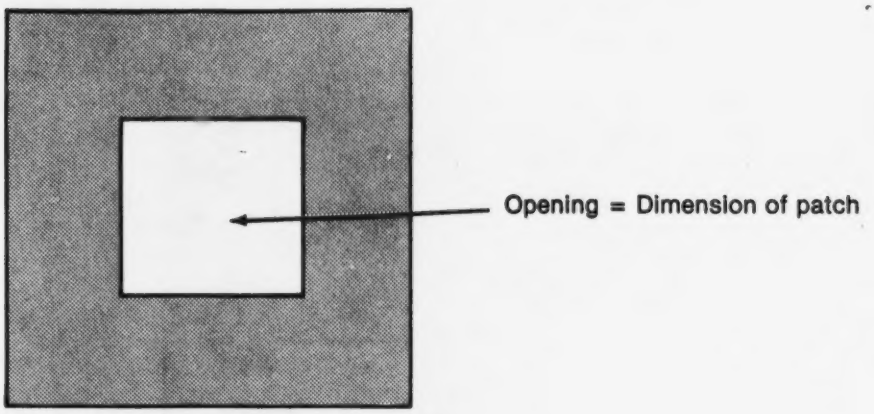
(NOTE: The patch must be large enough to extend beyond the damaged area and overlap the original fabric surface by at least one inch.)

H. Apply patch using Poly-Tak and ½-inch acid brush

I. Allow 15 minutes for Poly-Tak to dry

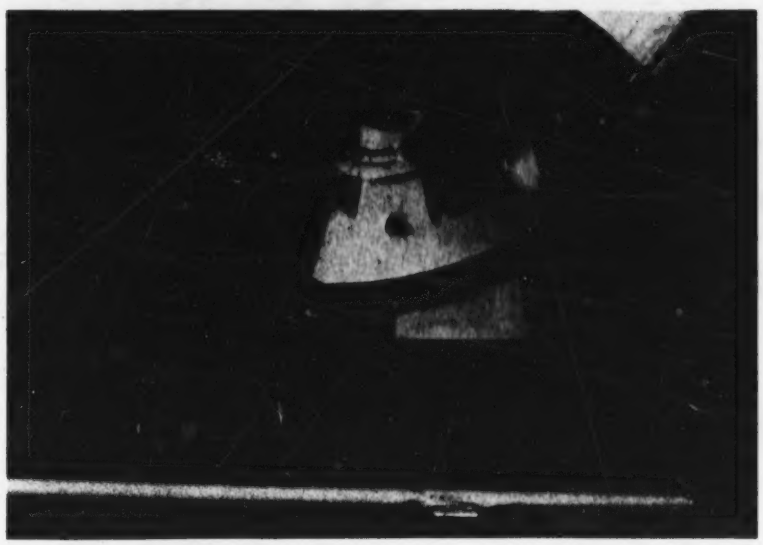
J. Fabricate a cardboard heat barrier, and place on patch overlap area (Figure 31)

FIGURE 31



K. Iron patch with iron set to 225°F (Figure 32)

FIGURE 32



L. Iron patch with iron set to 350°F for final tightening

M. Remove cardboard heat barrier

N. Use tack rag to remove dust and residue from surface

O. Apply first coat of Poly-Brush with 2-inch polyester tapered-bristle brush, and allow to dry

(NOTE: Apply Poly-Brush with the surface in a vertical position to prevent drip-through.)

P. Centering finishing tape along patch edges, apply finishing tape on all edges of patch

Q. Apply second coat of Poly-Brush with 2-inch polyester tapered-bristle brush, and allow to dry

(NOTE: Avoid overbrushing the area so that Poly-Brush will not rope.)

R. Clean work area, and return tools and equipment to proper storage area

Procedure in this project guide adapted with permission of Stits Aircraft, from *Stits Poly-Fiber Covering & Painting Manual*, Procedure Manual No. 1, rev. 13, Jan. 1983, 2nd ed., by Ray Stits.

AIRFRAME
A203 AIRCRAFT FABRIC COVERING, PAINTING, AND FINISHING
INSPECT, TEST, AND INSTALL AIRCRAFT FABRIC COVERINGS
A203-A

THEORY TEST

1. Match terms related to inspecting, testing, installing, and repairing aircraft fabric coverings to their correct definitions. Write the correct numbers in the blanks.

_____a. Finish for aircraft fabric, consisting of a film base of cellulose fibers dissolved in nitric acid, with the necessary plasticizers, thinners, and solvents

_____b. Certificate authorizing an alteration to an airframe, engine, or component which has been granted an Approved Type Certificate

_____c. Long-staple cotton fabric with 80 threads per inch in both the warp and fill directions

_____d. Material such as starch used to stiffen the yarns for ease in weaving the cloth

_____e. Flammable liquid ketone (C_3H_6O) used as a solvent and a constituent in many aircraft finishes

_____f. Direction across the width of the fabric; threads that run at a right angle to the selvage

_____g. Strong fabric made from flax

_____h. Lengthwise edge of cloth, tape, or webbing woven to prevent raveling

_____i. Number of threads per inch in warp or filling

_____j. Advisory circular in book form issued by the Federal Aviation Administration which covers acceptable methods, techniques, and practices for aircraft inspection and repair

_____k. Woven threads that run the length of the fabric

_____l. Synthetic polyester fiber fabric in its unshrunk condition as it comes from the loom

1. Acetone
2. Supplemental Type Certificate (STC)
3. Selvage edge
4. Grade-A cotton
5. Nitrate dope
6. Irish linen
7. Filling, woof, or weft
8. Sizing
9. Count
10. Warp ends
11. AC 43.13-1A
12. Greige Dacron

_____m. Process of ironing fabric by threading it wet between a series of hot and cold rollers to produce a smooth finish

_____n. Synthetic fiber noted for its mechanical strength, chemical stability, and long life

_____o. Short fiber ends which protrude from the surface of a fabric

_____p. Direction along the length of fabric; threads that run parallel to the selvage

_____q. Registered trade name for a fabric woven from polyester fibers

_____r. Cut, fold, or seam made diagonally to the warp or fill threads

_____s. Finish for aircraft fabric, consisting of a film base of cellulose fibers dissolved in acetic and butyrate acids, with the necessary plasticizers, solvents, and thinners

_____t. Edge which has been cut by machine or shears in a continuous series of Vs to prevent raveling

_____u. Number of yarns making up a thread

_____v. Registered trade name for polyester fibers made by the E.I. DuPont de Nemours & Company

_____w. Process of dipping cotton yarn or fabric in a hot solution of diluted caustic soda

_____x. Identifying letters required on an aircraft part or component to signify it as being manufactured under a Federal Aviation Administration Parts Manufacturing Approval

_____y. Textile fiber of relatively short length that when spun and twisted forms a yarn rather than a filament

13. Warp
14. Bias
15. Polyester fiber
16. Butyrate dope
17. Nap
18. Poly-Fiber
19. Calendering
20. Mercerization
21. Ply
22. FAA-PMA
23. Pinked edge
24. Dacron
25. Staple

2. The aircraft maintenance technician must follow established guidelines for the installation of a fabric covering on an aircraft structure. List approved data sources used to establish procedures for the installation of fabric coverings on aircraft.

   a. _____

   b. _____

   c. _____

   d. _____

3. There are many types of materials available to the technician for use in a fabric covering job, and the technician must be able to identify materials which are suitable for aircraft use. Explain what is meant by the phrase *approved materials* and how you can be sure you are using approved materials.

   _____

   _____

   _____

   _____

   _____

   _____

4. The majority of all fabric covering being used in aviation today occurs in three specific areas or categories of aircraft. Name the categories of aircraft still using fabric covering materials and processes.

   a. _____

   b. _____

   c. _____

5. There are a variety of fabric covering systems which can be used for covering aircraft. Explain what is meant by the phrase *fabric covering system*.

   _____

   _____

   _____

   _____

   _____

   _____

6. The aircraft maintenance technician must know the characteristics of materials used in maintenance processes and must know how to skillfully use them in the processes. Select statements related to material characteristics and processes used in the reference (cotton and linen) covering system. Circle the numbers before the correct answers.

   a. The minimum allowable tensile strength of new grade-A (TSO-C15) aircraft cotton fabric in pounds per inch warp and fill is

      1) 46

      2) 80

      3) 100

      4) 65

   b. Fungicidal dopes are used in aircraft finishing as the

      1) first full-bodied, brushed-on coat to prevent fungus damage

      2) first coat to prevent fabric rotting and are applied extremely thin to saturate the fabric

      3) finish clear coat to provide a glossy appearance and to prevent deterioration of the fabric

      4) final full-bodied, brushed-on coat to reduce blushing

   c. Reinforcing tape is flat woven tape made of cotton available in 1/4-inch, 3/8-inch, and 1/2-inch widths and having a strength of

      1) 1000 pounds per half inch of width

      2) 250 pounds per half inch of width

      3) 150 pounds per half inch of width

      4) 500 pounds per half inch of width

   d. The tape made of the same material as the covering fabric and used over all of the seams, over all of the ribs, around all corners, and along the leading edges, around the tips, and along the trailing edges of all of the surfaces is called

      1) double-backed installation tape

      2) seam tape

      3) machine tape

      4) surface tape

e. The reference rib lacing cord is made of cotton fibers which are

1) prewaxed with beeswax

2) prewaxed with candle wax

3) prewaxed with paraffin

4) prewaxed with liquid wax

f. Hand sewing thread with 8/4-ply yarn size has a single tensile strength of

1) 14 pounds

2) 44 pounds

3) 75 pounds

4) 100 pounds

g. Aluminum paste is mixed with clear dope using the ratio of

1) two pounds of paste to five gallons of dope

2) one pound of paste to five gallons of dope

3) five pounds of paste to five gallons of dope

4) one-half pound of paste to five gallons of dope

7. There are specific times when a determination of fabric strength must be made by the maintenance technician. Discuss methods, time intervals, and fabric strength ratings to be used when determining the need for recovering a fabric structure by answering the following questions.

a. When is the maintenance technician required to determine a fabric's strength?

_____

_____

b. Aircraft fabric is considered airworthy until it deteriorates to what condition?

_____

_____

c. What is indicated if the technician is performing a punch test on aircraft fabric and only the red band shows on the tester?

_____

_____

d. How far must the point of the punch tester break the surface of the fabric?

_____

_____

e. What must be done if the fabric fails the punch test?

_____

_____

f. Where is the greatest deterioration likely to occur on a fabric-covered aircraft?

_____

_____

8. Fabric removal from the aircraft structure must be accomplished in a responsible manner or damage to the structure could result. Select statements related to fabric removal from aircraft structure. Circle the numbers before the correct answers.

a. When it is determined that the aircraft's fabric covering should be removed, disassemble the aircraft, and prepare it for recovering according to the

1) local repair station's policies

2) sound mechanical techniques

3) manufacturer's service manual

4) *Homebuilder's Maintenance Magazine*

b. The best policy to use when removing fabric from the structure is to

1) remove all the fabric from the structure at one time so that the structure can dry out

2) leave each major component covered until you are ready to work on it

3) remove all the fabric before disassembling any of the aircraft's structure

4) dispose of it as soon as it is removed from the structure

9. After removing the fabric, it is necessary to carefully inspect the airframe structure and prepare it properly for recovering because it will be many years before some of the structure is visible again for inspection. Select true statements related to inspecting the aircraft structure and preparing it for recovering. Write an "X" in the blanks before the correct answers.

_____a. Check all steel tubing, especially the highest part of the structure, when the aircraft is on the ground

_____b. Prime aircraft tubing with an epoxy primer

_____c. Examine wood formers and stringers for evidence of rot, and give them a coat of clear spar varnish

_____d. Examine all of the landing gear and wing fittings to be sure that none of them are cracked or have elongated holes

_____e. Cover all screw heads and the edges of all of the metal sheets that will touch the fabric with cloth tape to prevent their wearing through the fabric

_____f. Check all bolts in control systems and other parts of the structure for wear and proper safety

10. The cotton and linen system is the reference system for fabric covering. Once a technician is knowledgeable about the reference system, he or she will be able to use this knowledge to analyze the alternative fabric systems available through Supplemental Type Certificates. Select statements related to procedures used to install cotton and linen covering systems. Circle the numbers before the correct answers.

a. Whenever operations involving sanding, rubbing, or wiping of detached fabric-covered wings are to be performed, the surface should always be

1) coated with water to prevent scratching of the finish during the finishing process

2) grounded to prevent accumulation of static charges during the finishing process

3) coated with water to prevent overheating of the finish during the finishing process

4) located in a room in which the relative humidity is not more than 20 percent. By closely controlling the relative humidity, the material used for sanding, rubbing, or wiping will remain dry during the entire operation

b. Fabric coverings are laced to the wing structure for the purpose of maintaining the contour of the airfoil and to prevent lifting and whipping of the fabric in flight. The lacings should be secured by the use of seine knots

1) tied on the outside and then pulled into the wing structure

2) positioned in the middle of the top cap strip for aircraft with a never-exceed speed of 150 mph or less

3) positioned in the middle of, or along the edge of, the bottom cap strip

4) which should never extend above the adjacent wing surface

c. When finishing a fabric surface, apply

1) at least the number of coats necessary to result in a taut and well-filled finish job

2) a minimum of eight coats

3) three coats of clear, two coats of aluminum, and four coats of pigmented dope

4) the first three coats of dope by brush and the remaining five coats by spray gun

d. When and how is finishing tape applied on a fabric-covered aircraft?

1) Doped on at the same time the last coat of dope or lacquer is applied

2) Sewed or laced on before dope is applied

3) Doped on immediately prior to the finish coat

4) Doped on after the first or second coat of dope

e. A practical method of determining whether a fabric surface has been finished with nitrate (cellulose nitrate) or butyrate (cellulose acetate butyrate) dope is to

1) rub a small section with lacquer thinner; butyrate finish will not be affected, but nitrate finish will be softened

2) remove a 1-inch-wide strip of fabric and conduct a tensile test

3) press the thumb firmly against an unsupported section of the fabric, and note the time required for the fabric to recover its original shape

4) observe the reverse side of the fabric for evidence of blue dye (butyrate) or red dye (nitrate) that has penetrated as a result of brushing on the first two coats of dope

f. Prior to application of surface tape to the trailing edge of a wing or control surface, the tape should be notched at intervals to

1) prevent raveling of the tape

2) make it easier to apply to severe curvatures

3) increase the length of the tape's edges for better doping

4) prevent the entire tape from loosening in the event the tape begins to separate from the surface

g. The chief purpose of pigment (or aluminum) in dope is to

1) make it easier to apply

2) make a more pleasing appearance

3) exclude sunlight from the fabric

4) give a covering that has a minimum of air resistance

h. Surface or finish tape is installed on fabric-covered aircraft for what purpose?

1) Prevent wear over lacings, seams, corners, and edges

2) Prevent warping of the surface during drying period of the dope

3) Prevent loosening of the entire fabric covering

4) Attach the fabric to the structure

11. Dacron is a widely used synthetic material which is available under various Supplemental Type Certificates for covering aircraft structures. Select statements related to materials and procedures used in the Dacron fabric system. Circle the numbers before the correct answers.

a. All three of the systems approved for the installation of Dacron fabric use

1) dope to shrink the fabric

2) heat to shrink the fabric

3) a special chemical available through the manufacturer to shrink the fabric

4) a special set of fabric clamps to stretch the fabric on the structure

b. Any deviation from the system would prevent the application

1) of the finishing materials on the fabric's surface

2) of the fabric to the structure of the aircraft

3) manual being used as approved data

4) of the trim letters used to identify the aircraft

c. The drain grommets and inspection rings are installed at the same time the

1) fabric is attached to the structure

2) the reinforcing tape is installed

3) fabric is tautened using the heat shrink method

4) the surface tape is laid down

12. Glass cloth, or fiberglass cloth, is made from finely-spun glass filaments which are woven to make a strong, tough fabric. As an aviation maintenance technician, you must possess the knowledge to work competently with glass cloth. Discuss the glass cloth covering system by answering the following questions.

a. What type of dope should be used when working with glass cloth?

_____

b. Since the glass filaments do not shrink, on what does the tautening of the cover depend?

_____

_____

c. How is the dope used with glass cloth applied to the surface?

_____

_____

d. A complete or partial reinforcement of a serviceable fabric covering is what class of application?

_____

_____

e. A replacement covering, applied either independently or over a conventional covering, which is in no way dependent upon the underlying covering if one is present, is what class of application?

_____

13. The repair of fabric coverings must be accomplished in accordance with approved data. As an aviation maintenance technician, you must be able to use your knowledge and skill to perform these repairs. Discuss fabric repairs by answering the following questions.

a. Which type of stitch is used for performing a sewn-type repair on aircraft fabric?

_____

b. When performing a doped-in panel repair, how far should the new fabric extend beyond the ribs which border the repair?

_____

14. There are specific criteria which necessitate the usage of a particular repair procedure. Match specific repairs used on fabric covering to the following damage criteria. Write the correct numbers in the blanks.

_____a. Damage does not extend more than 16 inches in any direction, and the aircraft has a never-exceed speed of 150 mph or less

_____b. Damage exceeds more than 16 inches in any one direction

_____c. Damage does not exceed 16 inches in any direction, and the aircraft has a never-exceed speed of more than 150 mph

1. Doped-in panel
2. Doped-on patch
3. Sewn-in patch

15. Describe the acceptable condition of a fabric covering, in relation to the required strength and tautness, after the repair is complete.

_____

_____

_____

_____

_____

_____

16. One common type of damage to aircraft fabric is the L-shaped tear. Arrange in order the steps used to repair an L-shaped tear in fabric. Write a "1" in the blank before the first step, a "2" in the blank before the second step, and so on.

    _____a. Cut the patch with pinking shears

    _____b. Brush some butyrate dope around the tear, and allow it to soften the finish

    _____c. Remove the dope down to the clear coats for a distance of at least 1½ inches from the tear

    _____d. Finish repaired area in manner similar to the rest of the covering

    _____e. Sand to remove the nap of the fabric

    _____f. Sew the tear beginning at the apex of the tear and working outward using a baseball stitch

    _____g. Use a dull knife to scrape away the dope after it softens

    _____h. Brush a coat of dope over the cleaned-out area

    _____i. Apply additional coats of dope to return repaired area to original smoothness

    _____j. Lay the patch in place

    _____k. Apply a good, solid coat of dope to the patch, and allow to dry

(NOTE: Test questions 17-19 are project guides. They are an important part of this test. If they have not been completed, check with your instructor.)

17. Inspect and test aircraft fabric covering.

18. Install aircraft fabric covering.

19. Repair aircraft covering using a doped-on patch.

AIRFRAME
A203 AIRCRAFT FABRIC COVERING, PAINTING, AND FINISHING
INSPECT, TEST, AND INSTALL AIRCRAFT FABRIC COVERINGS
A203-A

ANSWERS TO THEORY TEST

1.

a. 5	j. 11	r. 14
b. 2	k. 10	s. 16
c. 4	l. 12	t. 23
d. 8	m. 19	u. 21
e. 1	n. 15	v. 24
f. 7	o. 17	w. 20
g. 6	p. 13	x. 22
h. 3	q. 18	y. 25
i. 9		

2. a. Manufacturer's service manual
   b. AC 43.13-1A&2A
   c. Supplemental Type Certificates
   d. Field approval

3. Approved materials meet the required specifications, established by the FAA and the manufacturer, necessary to maintain the aircraft in an airworthy condition; the technician can recognize these materials by their specification codes and the FAA-PMA stamp

4. a. Restoration of antiques
   b. Construction of amateur-built aircraft
   c. Commercial recovering of special-purpose aircraft (agricultural)

5. A fabric covering system includes not only the fabric, but all of the tape, thread, and finish and the method of installation; the materials of one system are not necessarily legal for use with another system

6.

a. 2	e. 1
b. 2	f. 1
c. 3	g. 2
d. 4	

7. a. At every 100-hour and annual inspection
   b. 70 percent of the strength of new fabric required for the aircraft
   c. The fabric is weak
   d. Far enough to allow the face to contact the surface
   e. Perform the pull test
   f. The top of the wing or fuselage, especially in an area that is painted with a dark finish

ANSWERS TO THEORY TEST

8. a. 3
   b. 2

9. b, c, d, e, f

10. a. 2
    b. 3
    c. 1
    d. 4
    e. 1
    f. 4
    g. 3
    h. 1

11. a. 2
    b. 3
    c. 4

12. a. Butyrate
    b. Tautening depends upon the doped finish bonding tightly to the glass
    c. With a spray gun
    d. Class A
    e. Class C

13. a. Baseball stitch
    b. Three inches

14. a. 2
    b. 1
    c. 3

15. The repair will have returned the fabric to its original strength and tautness

16. a. 5
    b. 2
    c. 4
    d. 11
    e. 9
    f. 1
    g. 3
    h. 6
    i. 10
    j. 7
    k. 8

17. Performance skills evaluated to the satisfaction of the instructor

18. Performance skills evaluated to the satisfaction of the instructor

19. Performance skills evaluated to the satisfaction of the instructor

MODULE OF INSTRUCTION
FOR
AVIATION MAINTENANCE TECHNOLOGY

AIRFRAME

A203 AIRCRAFT FABRIC COVERING, PAINTING, AND FINISHING

APPLY DOPE, PAINT, AND TRIM

A203-B

AIRFRAME
A203 AIRCRAFT FABRIC COVERING, PAINTING, AND FINISHING
APPLY DOPE, PAINT, AND TRIM
A203-B

MODULE CONTENTS

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2. Technical Information Supplement #2 — Digest of Finishing Problems

3. Technical Information Supplement #3 — Special Finishes and Finishing Products

4. Technical Information Supplement #4 — Uses and Characteristics of Wash Primer and Zinc Chromate Primer

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2. TM #2 — Adjusting the Spray Pattern

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8. TM #8 — Spraying Techniques (Continued)

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10. TM #10 — Spraying Sequence (Continued)

11. TM #11 — Spraying Sequence (Continued)

G. Project Guides

1. Project Guide #1 — Finish a Fabric-Covered Surface

2. Project Guide #2 — Apply Registration Letter to Finished Surface

H. Theory Test

I. Answers to Theory Test

INTRODUCTION

After an aircraft has been designed, engineered, assembled, rigged, and finely tuned, it still is not a special work of art until it receives its final finish. Aircraft painters are the professional craftsmen who are responsible for applying the final finish to aircraft.

Aircraft finishes provide protection for aircraft. Proper finishes protect fabric coverings from mildew, rot, and the harmful effects of sunlight and moisture and protect metal surfaces from corrosion. Special finishes protect against abrasions, chemicals, and even battery acids. Special finishes also increase safety by making aircraft and their propellers highly visible, by making wing walks less slippery, and by preventing sunlight from being reflected into the pilot's eyes.

MODULE OBJECTIVE

After completion of this module, you will be able to demonstrate procedures for finishing a fabric-covered surface and for applying a registration letter to a finished surface. Your competency will be evaluated by completing workbook assignments, project guides, and by scoring a minimum of 85 percent on the module theory test.

SPECIFIC OBJECTIVES

After completion of this module, you should be able to:

1. Match terms related to aircraft finishing materials and equipment to their correct definitions. (1)	Technical Supplement #1	
2. State safety precautions related to handling and storing aircraft finishing materials. (1)	EA-ITP-AB EA-ITP-ASG	187 49-50:74-77
3. State the drawback of the traditional dope finish which has caused refinishers to consider newer systems. (1)	EA-ITP-AB EA-ITP-ASG	164 45:1
4. Select true statements related to dope rejuvenation. (1)	EA-ITP-AB EA-ITP-ASG	165 46:2-5
5. Discuss the finishing process in relation to the application of dope. (2)	EA-ITP-AB AC 65-15A EA-ITP-ASG	165 107-111 46:6-8
6. Match finishing problems to their causes. (1)	Technical Supplement #2 EA-ITP-AB AC 65-15A EA-ITP-ASG	 165-167 109-110 46:9-19
7. Select true statements concerning the use of a polyurethane finish on a fabric-covered airframe. (1)	EA-ITP-AB EA-ITP-AW EA-ITP-ASG	167 3:I:7-8 46:20-21
8. Match special finishes and finishing products to their uses. (1)	Technical Supplement #3	
9. Match paint finish identification tests to test results. (1)	AC 65-15A	117
10. Select true statements concerning procedures and processes for stripping paints from metal surfaces. (2)	EA-ITP-AB AC 65-15A EA-ITP-ASG	167-168 117-118 47:22-27
11. Explain the cause of filiform corrosion and how it can be prevented. (2)	EA-ITP-AB EA-ITP-ASG Technical Supplement #4	168-169 47:28

12. Discuss the use and application of conversion coatings and wash primers. (2)	EA-ITP-AB AC 65-15A EA-ITP-ASG Technical Supplement #4	168-169 118-119 47:29-30
13. Select true statements concerning zinc chromate primer. (1)	AC 65-15A Technical Supplement #4	115, 122
14. Select true statements relative to acrylic lacquers and their application. (2)	EA-ITP-AB AC 65-15A EA-ITP-ASG	168-169 114, 119-120 47:31-33
15. Discuss the polyurethane finishing system. (2)	EA-ITP-AB AC 65-15A EA-ITP-AW EA-ITP-ASG	169-170 120-121 3:II:9-10 47:34-40
16. Select true statements concerning paint room safety practices and proper usage of respirators and masks. (1)	EA-ITP-AB EA-ITP-ASG	170-173 48:41-42
17. Discuss air-supply requirements for painting. (2)	EA-ITP-AB AC 65-15A EA-ITP-ASG	171 123 48:43
18. Select true statements concerning painting equipment. (1)	EA-ITP-AB EA-ITP-AW EA-ITP-ASG	171-174 3:III:10 48:44-49
19. Identify parts of a spray gun. (2)	EA-ITP-AB	175-176
20. Discuss the setup, adjustment, and cleaning of spray equipment. (2)	EA-ITP-AB EA-ITP-ASG	174-176, 179-180 48:50-53
21. Match spray-pattern distortions to their causes. (1)	EA-ITP-AB EA-ITP-ASG	176 48-49:54-59
22. Select statements concerning finish application. (2)	EA-ITP-AB EA-ITP-AW EA-ITP-ASG	176-178 3:IV:10-11 49:60-61
23. Discuss trim and registration number application. (2)	EA-ITP-AB AC 65-15A EA-ITP-AW EA-ITP-ASG	180-187 125-126 3:V:11-12 49:66-72

24. Arrange in proper sequence the steps for painting an airplane. (2)	EA-ITP-AB EA-ITP-ASG	179 49:62-63
25. Finish a fabric-covered surface. (2)	Project Guide #1	
26. Apply registration letter to finished surface. (2)	Project Guide #2	

AIRFRAME
A203 AIRCRAFT FABRIC COVERING, PAINTING, AND FINISHING
APPLY DOPE, PAINT, AND TRIM
A203-B

INSTRUCTOR'S MODULE IMPLEMENTATION GUIDE

I. Order materials to supplement module:

A. Videotapes

1. *Aircraft Painting*, EA-AP

2. *Aircraft Painting Tips*, EA-APT

(NOTE: These videotapes are available from International Aviation Publishers, P.O. Box 36, 1000 College View Drive, Riverton, Wyoming 82501-0036.)

B. Training manuals

1. *Aircraft Painting and Finishing*, EA-AP-2

(NOTE: This manual is available from International Aviation Publishers, P.O. Box 36, 1000 College View Drive, Riverton, Wyoming 82501-0036.)

2. *Stits Poly-Fiber Covering & Painting Manual*, Procedure Manual No. 1, Rev. 13, 2nd ed., January, 1983.

(NOTE: This is the revision referenced in Project Guide #1. However, obtain the most current edition available for use with the module. This manual is available from Stits Poly-Fiber Aircraft Coatings, P.O. Box 3084, Riverside, CA 92519.)

II. Implementation Suggestions

(NOTE: Preview videotapes prior to beginning module to determine how they relate to the specific objectives. Have students read all available resource material related to specific objectives.)

Estimated Teaching Time		Theory	Lab
Objective 1	Use Technical Information Supplement #1 to discuss the terms and definitions related to aircraft finishing systems, materials, application, and equipment. Have students refer to illustrations of various painting defects in their textbooks. Ask students to write any unfamiliar terms they encounter as they complete their reading assignments. Have the class attempt to define these terms. Make copies of Instructional Supplement #1 and review with the class.		

Estimated Teaching Time		Theory	Lab
Objective 2	Discuss the correlation between a professional approach toward aviation maintenance and the development of safety attitudes. Explain the dangers involved with storing and handling finishing materials. Emphasize the dangers of breathing fumes from certain materials and the proper precautions needed when using these materials. Be sure to point out improper procedures which can increase the potential for fire. Use Instructional Supplement #2.		
Objectives 3-4	Discuss the traditional dope finish and its advantages. Explain what happens to plasticizers and flexibilizers as a dope finish ages. Show an example of ringworming, and emphasize the loss of strength caused by sunlight and moisture attacking the fabric through such cracking. Describe how rejuvenation can eliminate this problem. Discuss the proper application of a rejuvenator.		
Objective 5	Discuss the application of dope-finish topcoats. Explain how a deep gloss finish is obtained, and show an example of a properly finished surface.		
Objective 6	Discuss the problems commonly encountered when applying dope finishes, and emphasize how to prevent or correct them. Show examples of the various types of problems, and have students read Technical Information Supplement #2.		
Objective 7	Explain the problems encountered when applying a polyurethane topcoat on a fabric surface. Discuss the newer polyurethane topcoats formulated for flexibility and the importance of following manufacturer's recommendations when using these products. Emphasize in your discussion the method used for removing polyurethane topcoats when fabric repairs are necessary. Have students complete EA-ITP-AW 3:I:7-8.		

Estimated Teaching Time		Theory	Lab
Objective 8	Have students read Technical Information Supplement #3. Discuss the various types of special finishing products and finishes found on aircraft and their importance and application. Show examples of the various types of finishes		
Objective 9	Explain the importance of being able to determine the type of finishing system found on an aircraft. Discuss finish identification tests, emphasizing the importance of following the specified steps in a proper sequence. Demonstrate the testing process in the shop. Show how a finish can be ruined if test is completed using the wrong sequence.		
Objective 10	Explain how paint strippers attack and remove various finishes. Emphasize the importance of following the manufacturer's recommended procedures when using strippers and for protecting those parts of the aircraft which could be damaged by strippers. Discuss the proper application of strippers and the importance of removing all traces of old finish and residue. Discuss paint removal from non-metallic surfaces. Demonstrate the stripping process on a small section of a painted metal surface.		
Objective 11	Discuss the importance of thoroughly inspecting for corrosion any time paint has been removed from a metal surface. Show an example of filiform corrosion. Explain the causes of filiform corrosion and how it can be prevented. Use Technical Information Supplement #4. Discuss corrosion removal.		
Objectives 12-13	Discuss preparing metal for painting and the importance of removing all surface flaws from the metal before painting. Use Technical Information Supplement #4, and discuss conversion coatings, wash primers, and zinc chromate primers.		

Estimated Teaching Time		Theory	Lab
Objective 14	Discuss acrylic lacquer and its application process. Explain primers to be used with acrylic lacquer, and emphasize the incompatibility of acrylic lacquer with old yellow zinc chromate primer and nitrocellulose finishes. Show videotape, *Aircraft Painting*.		
Objective 15	Discuss the properties of polyurethanes. Explain how their slow-flowing characteristics make their finishes so attractive. Discuss epoxy primers. Explain what a catalyst is and the meaning of *cure time*. Explain the use and importance of a viscosity cup. Emphasize how polyurethane catalysts are reactive to water and the potential of bursting a sealed can of activated catalyst. Discuss *pot life* and the importance of promptly cleaning equipment after use.		
Objective 16	Discuss paint room cleanliness. Explain paint room safety precautions regarding lighting, ventilation, and finishing-material storage. Conduct a safety tour of the paint shop. Have students note any safety violations, and then discuss any appropriate remedies. Familiarize students with the location of light switches and ventilating fan switches and with equipment and material storage locations and storage procedures.		
Objective 17	Emphasize the importance of having an adequate supply of clean, contaminate-free air for painting. Discuss the effects of too much or too little air pressure when spraying finishing materials. Demonstrate how to properly adjust air pressure at the spray gun. Explain and demonstrate the effects of using long lengths of air hose, and show how to empty air transformers and any other water-trapping devices in the paint shop air-supply system.		

Estimated Teaching Time		Theory	Lab
Objective 18	Show a respirator mask and an airflow-type respirator. Explain when and how each type is used. Demonstrate how to put on and adjust each type. Demonstrate and explain how a viscosity cup is used when adjusting viscosity. Show a pressure pot and suction cup, and explain how each system differs in setup and application. Have students complete EA-ITP-AW 3:II-III:9-10.		
Objectives 19-20	Identify the parts of a spray gun. Compare an actual spray gun with Transparency Master #1. Explain how the trigger air valve opens air and paint orifices in the gun. Using Transparency Masters #1 and #2, explain how the paint is atomized. Explain how adjusting the wing port air valve varies the size and shape of the fan-shaped spray. Point out why the shape of the fan is perpendicular to the position of the wing ports. Explain the importance of cleaning spray equipment in a timely manner, and explain how to clean a spray gun using Transparency Master #3. Demonstrate how to connect, set up, and clean the spray equipment.		
Objectives 21-22	Discuss spray-pattern problems using Transparency Master #4. Explain proper spraying distance and spray-pattern size. Discuss the proper technique for holding the gun while applying finishing material and the results of arcing and tilting the gun. Use Transparency Masters #3-#7. Explain the importance of spraying corners and edges first and how to properly overlap successive passes. Use Transparency Master #8. Have students complete EA-ITP-AW 3:IV:10-11.		

Estimated Teaching Time		Theory	Lab
Objective 23	Discuss trim layout materials and types of masking tape. Show examples of common masking tape and polyurethane tape. Explain the importance of removing tape at the correct time, and demonstrate the proper method for tape removal. Review the FARs that relate to placement and size of aircraft registration numbers. Demonstrate how to lay out a registration number or letter using an 18 template or transparent plastic guide. Show videotape, *Aircraft Painting Tips*. Have students complete EA-ITP-AW 3:V:11-12		
Objective 24	Using Transparency Masters #9-#11, discuss the proper sequence for painting an airplane. Have students complete EA-ITP-ASG 45-50:1-77 for a comprehensive review.		
Objectives 25-26	Discuss Project Guides #1 and #2 with the class; review all pertinent safety rules and precautions, and demonstrate all procedures. Have students complete the projects. Review the projects in class after all students have completed.		

INSTRUCTIONAL SUPPLEMENT #1 — Material Requirements for Refinishing Typical Light Airplanes

Fabric Covered Aircraft Such as Tri-Pacer

Nitrate cement, for fabric attachment .....1 gallon
Nitrate clear dope (for first coat).....10 gallons
Nitrate thinner.....10 gallons
Butyrate clear dope .....25 gallons
Butyrate thinner .....25 gallons
Colored butyrate dope (basic color) .....10 gallons
Colored butyrate dope (trim color) .....1 gallon
Butyrate retarder.....as required by conditions
Aluminum paste .....2 pounds
Epoxy primer and mixing liquid .....1 ½ gallons each

(NOTE: For finishing an aircraft such as a Bellanca Viking, double the quantity of clear dope and thinner.)

Average Single-Engine, Four-Place, All-Metal Airplane

Acrylic Lacquer System

Wash Primer System
- Wash primer .....4 quarts
- Acid diluent.....2 pints
- Thinner .....4 quarts

Epoxy Primer System (alternate and preferred method, if time permits.)
- Epoxy primer.....4 quarts
- Epoxy catalyst .....4 quarts
- Epoxy primer reducer.....2 gallons

Acrylic color .....6 gallons
Acrylic thinner.....10 gallons

Polyurethane System

Epoxy primer.....4 quarts
Epoxy catalyst .....4 quarts
Epoxy primer reducer.....2 gallons
Polyurethane color .....2 gallons
Polyurethane catalyst.....2 gallons
Polyurethane reducer.....2 quarts

Refer to the appropriate portion of *Aircraft Painting and Finishing*, EA-AP-1, for the application technique and curing time.

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INSTRUCTIONAL SUPPLEMENT #2 — Polyurethane Paint Safety

The use of polyurethane paints requires that certain safety precautions, attention to health hazards, and medical surveillance be observed and that protective equipment be worn. The following information is taken from United States Coast Guard Aviation Technical Note 2-68B.

Safety Precautions

A. During transit and storage of polyurethane paints, a safety hazard exists when a defective batch of resin undergoes slow deterioration as a result of moisture contamination. This resin defect manifests itself in the form of a bulging can, by the emission of other than the normal odor, or by a change in the resin from a clear to a cloudy state. This defect will result in a slow buildup of carbon dioxide, the pressure of which could cause the paint can to burst with sudden explosive violence. To minimize complications which may result from resin defects, paint shop personnel should periodically inspect incoming containers of polyurethane paints for signs of defective resins as outlined above. All defective material as described above should be removed and disposed of with caution, and the incident appropriately reported.

B. When painting a complete aircraft or working in confined areas, adequate ventilation and/or appropriate face mask breathing protection should be provided to minimize toxicity effects.

Health Hazards

A. Polyurethane paints can produce irritation of the skin, eyes, and respiratory tract during mixing and application. Allergic sensitization of personnel exposed to the vapors and mists produced during spray application may occur and cause difficulty in breathing, dry cough, and shortness of breath. Individual susceptibility appears to be a controlling factor. Once sensitized, many workers cannot tolerate even a minimum subsequent exposure and must thereafter avoid areas where such exposure could occur.

Medical Surveillance

For production-type painting, medical surveillance as described below should apply to personnel mixing or applying the paint.

A. Selected persons shall receive a medical evaluation prior to assuming these tasks. Persons found to be medically qualified and assigned to perform these tasks will be reevaluated at specified intervals. The medical evaluation shall include but not necessarily be limited to the following:

    1. A complete medical history to exclude personnel with any cardiac ailment or respiratory disease, e.g., asthma, emphysema, or respiratory allergies.

2. A physical examination shall be repeated annually.

3. A complete blood count and chest X-ray (14" × 17") shall be obtained initially and repeated annually.

4. Pulmonary function studies to include a one-second forced expiratory volume (FEV-1) shall be conducted initially and repeated semiannually.

B. Personnel involved in painting operations who display any of the symptoms described in Health Hazards shall be removed from the painting assignment.

Protection Equipment

A. Production-type mixing and spray painting operations shall be conducted in specially designed, exhaust-ventilated areas, using personal protective equipment as follows:

1. A well-fitted, double-cartridge organic vapor respirator with fresh cartridges inserted daily

2. Solvent-resistant, gauntlet-style gloves

3. Safety goggles

B. Painters should be fully clothed with collars buttoned and sleeves taped at the wrist.

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TECHNICAL INFORMATION SUPPLEMENT #1 — Terms and Definitions

A. Acid diluent — Constituent of wash primer that provides a mild etch to the surface of the metal for a better bond

B. Acrylic lacquer — Aircraft finish consisting of an acrylic resin vehicle and certain volatile solvents

C. Air impingement — Fault in a finish resembling a haze

(NOTE: Air impingement is caused by microscopic air bubbles carried to the surface in the paint when atomizing air pressure is excessive.)

D. Blushing — White or grayish cast which forms on a lacquer or dope film which has been applied under conditions of too high humidity

(NOTE: Blushing is actually nitrocellulose which has precipitated from the finish.)

E. Bond — Attachment of one material to another or of a finish to the metal or fabric

F. Burn-down coat — Coat of dope with some of its thinner replaced with retarder, sprayed on a blushed area to attack and reflow the surface and remove the blush

G. Catalyst — Agent which causes a chemical reaction within the solution

H. Conversion coating — Chemical solution used to form a dense, nonporous oxide or phosphate film on the surface of aluminum or magnesium alloys

I. Cross-coat — Second coat of paint sprayed at a 90-degree angle to the direction of the first coat of paint before the first coat flashes off

J. Cure — Chemical change which takes place in a finishing system which produces the desired surface

K. Dope-proof paint — Paint which will not be softened or lifted by dope

L. Dope roping — Condition in the application of dope in which the surface dries while the dope is being brushed

(NOTE: Dope roping results in a stringy, uneven surface.)

M. Enamel — Material whose pigments are suspended in a vehicle which cures by conversion of some of its solvents by heat, oxidation, or catalytic action

N. Epoxy primer — Two-part, catalyzed material used to provide a good bond between a surface and the topcoat

O. Filiform corrosion — Thread- or filament-like corrosion which forms on aluminum skins beneath polyurethane enamel

P. Fish eyes — Isolated areas on the surface which have rejected the finish because of wax or silicone contamination

Q. Flashing off — Drying of a finish to touch by the evaporation of certain of the solvents

(NOTE: The film is not dry and hard throughout.)

R. Glaze — Hard, smooth surface of a finishing system

(NOTE: Glaze must normally be broken or roughened before another coat of material will adhere to it.)

S. Induction period — Time period after catalyzed material is mixed in which the material is allowed to begin its cure before it is sprayed onto the surface

T. Mil — Metric term meaning 1/1000 inch

(NOTE: In painting, a mil usually refers to the thickness of a film.)

U. Mist coat — Very light spray coat of thinner or other volatile solvent with little or no color in it

V. Nonatomizing spray — Application of a material to a surface by a spray gun in which the material is fed in a solid stream rather than in tiny droplets

W. Phosphoric acid etchant — Constituent of a conversion coating which microscopically roughens the surface of metal being treated and deposits a phosphate film

X. Pigment — Powder or paste mixed with a finish to give the desired color

Y. Pinhole — Defect in a finish which appears as a tiny hole

(NOTE: Pinholes are caused by bubbles in the paint film.)

Z. Plasticizer — Constituent of dope used to provide resilience to the film

AA. Polyurethane — Polymerized film used as a topcoat system for aircraft finishing

(NOTE: Polyurethane produces a hard, chemical-resistant surface whose slow flow-out time gives it an extra-smooth or wet look.)

BB. Pressure-fed gun — Paint spray gun in which the material is fed to the gun by air pressure on the pot or cup holding the material

CC. Pressure pot — Container holding the material to be sprayed

DD. Primer — Material which provides a sandwich between the topcoats and the metal to provide a good bond

EE. Rejuvenation — Restoring of resilience to a dope film by opening up the film with potent solvents and allowing the plasticizers in the rejuvenator to replace those which have migrated from the dope

FF. Retarder — Slow-drying solvent used to prevent blushing or to provide a more glossy finish by allowing the material a longer flow-out time

GG. Ringworms — Circular pattern of cracks in a brittle dope finish that results when a blunt object presses against the fabric

HH. Suction-cup gun — Paint gun in which the material is held in a cup attached to the gun and is drawn into the atomizing air by suction created by the atomizing airflow

II. Tack coat — Very light coat of material sprayed on a surface and allowed to set until the solvents evaporate

(NOTE: The tack coat is then covered with the full, wet coat of material.)

JJ. Tack rag — Rag, slightly damp with thinner, used to wipe a surface after it has been sanded to prepare it for the application of the next coat of finish

KK. Thinner — Solvent mixed with a paint material to reduce its viscosity

LL. Wash primer — Sandwiching material which provides a mild etch to the metal surface and a good bond for the topcoats

(NOTE: Wash primer is suitable for high-volume production because of its short curing time.)

MM. Zahn cup — Special cup of definite size and shape with a hole in its bottom; used to measure viscosity of a material

(NOTE: The time required for the cup to empty determines the viscosity of the material.)

TECHNICAL INFORMATION SUPPLEMENT #2 — Digest of Finishing Problems

Rough finish:

Dope too cold or viscous; the aircraft, dope, and thinner should all be at the same temperature, about 70°F., before spraying

Fabric will not tauten:

Fabric put on too loose
Fabric allowed to remain undoped too long
Too much retarder used for thinning dope

Blushing:

Humidity too high
Moisture in spray system
Dope applied over a moist surface

Pinholing or blisters:

Water or oil in spray system or on surface
Undercoat not thoroughly dry
Too fast surface drying
Film coat too heavy

Bubbles and bridging:

Dope too cold, or not brushed out properly
Temperature of dope room too high

Runs and sags:

Use of improper equipment
Improper adjustment of equipment
Improper thinning or faulty spray technique

Dope will not dry:

Oil, grease, or wax on surface

Dull spots:

Porous spot putty or undercoating, allowing dope or lacquer to sink in

Bleeding:

Organic pigments or dyes used in the undercoats which are soluble in the topcoat solvents

White spots:

Water in spray system or on surface

Paint or primer peeling:

Wax from stripper or detergent from cleaning process may still be on surface

Brown spots:

Oil in spray system

Orange peel:

Spraying with too high pressure
Use of too fast drying thinner
Cold, damp draft over surface

Wrinkling:

Reaction between solvents and primer or undercoats

Overspray:

Wrong spray technique
Too fast drying thinner

Fish eyes:

Silicone, wax, or polish contamination on surface
Oil from air compressor

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TECHNICAL INFORMATION SUPPLEMENT #3 — Special Finishes and Finishing Products

A. High visibility finishes

The need to make aircraft more visible, both on the ground and in the air, has caused the paint manufacturers to develop a series of vivid color finishes for airplanes. Normally these finishes are not used for the complete airplane, but are used for wing tips, cowlings, the empennage, or colored bands around the fuselage.

These finishes consist of a coat of transparent pigment applied over a white, reflective base coat. Over the colored pigments is sprayed a clear, ultraviolet absorbing topcoat to help retard fading of the vivid transparent pigments. If the airplane has a good white finish on it, this may be used for the base coat.

Light penetrates the transparent topcoats, and it is reflected off the base; we see the colored reflection.

The application of these finishes is the same as for any sprayed-on finish. Be sure the reducer, the pigmented material, and the topcoat material are all compatible. Paint manufacturers sell all of this material in kit form, so you will have enough of all of the components for the relatively small amount used for the typical application. It is also available in bulk for larger applications.

B. Wrinkle finish

Instrument panels, electronic equipment, and other aircraft parts subject to considerable rough treatment may be finished with a wrinkled surface. This is essentially a material with very fast drying oils. The surface dries first, and as the bottom dries, it shrinks, pulling the surface into the desired wrinkle pattern. The size of the wrinkles is determined to a great extent by the formulation of the material.

All wrinkle finish material should be sprayed on the surface with a heavy coat and allowed to dry in the way recommended by the manufacturer. There are two types of finish: that which cures by heat and must be baked to produce the proper wrinkle and that which dries in the air and does not require baking.

Air-dry wrinkle finish available in aerosol spray cans is considerably softer than the baked finish and is not recommended where there will be much handling or wear. It is also not recommended that air-dry finishes be baked because the pigments will discolor, and you will not end up with the color you want.

C. Flat black lacquer

A durable, nonreflective coating for instrument panels and glare shields is flat black lacquer. This is sprayed on, either with a gun or from an aerosol spray can, and allowed to air dry. Flat finishes must be put on thin so they will not flow out and gloss. If they are put on too thick, there will be spotty areas of glossy finish in the predominantly flat coat.

D. Wing walk compound

A special sharp-grain sand is mixed into a tough enamel material to form nonslippery surfaces on airplanes for wing walks or any part of the airplane where a rough surface is desirable. It may be either brushed on with a coarse brush or sprayed using a special nozzle for the dense, highly abrasive material. It may be applied directly over the regular finish after thoroughly cleaning the surface and breaking the glaze if the finish is old. Wing walk compound may be thinned with toluol or other conventional enamel thinners.

E. Acid-proof paint

Battery boxes are one of the more corrosion-prone areas in an airplane because of the continual presence of acid fumes and occasional spilled acid. To prevent damage to the metal, battery boxes and all of the area surrounding the battery should be treated with an acid-proof paint. One of the commonly used materials is a black asphaltum material which resembles tar. It is thinned with toluol and brushed onto the surface after every trace of corrosion has been removed and the corroded area treated with a conversion coating such as Alodine.

An acid-proof finish, far superior to the black asphaltum paint, is a good coat of polyurethane enamel. When an airplane is being painted with polyurethane, a good coat on the battery box and the adjacent area will provide protection from the fumes of the lead-acid or nickel-cadmium batteries and will not chip or break away from the metal. Polyurethane will not wash away with gasoline or any ordinary solvents.

F. Float bottom compound

Seaplane floats take a beating, both from the abrasion of the water and from rocks on the beach or floating debris. In addition to the mechanical damage, they are subject to the maximum exposure to corrosive elements. For protection to the bottom of the float, a material similar to acid-proof paint may be used. It is an asphaltum product and is thinned to spraying consistency with toluol. If a black finish is not desirable on the bottom of the float, aluminum paste may be suspended in toluol and sprayed onto the black compound; the toluol will soften the material and allow the aluminum powder to embed in the finish.

Polyurethane enamel will provide a good abrasion-resistant finish for floats and may be used instead of the more conventional float bottom compound.

G. Fuel tank sealer

Built-up fuel tanks may develop seep leaks around rivets and seams. These can be stopped with a resilient, nonhardening tank sealer. Tanks which can be removed from the structure may be sealed by sloshing them with the sealer.

Tank preparation:

1. Drain the tank and ventilate it thoroughly.

2. Remove the tank from the airplane.

3. Remove the gage sender, vent line fittings, main line screen, and quick drain.

4. Rinse the tank with clean white gasoline to get rid of all of the fuel dyes, and air dry the tank for at least thirty minutes at room temperature. If the tank has been previously sealed, remove all of the old sealer by pouring about a gallon of acetone or ethyl acetate into the tank and sealing it up for an hour or two. The vapors will soften the sealer, and the liquid may then be sloshed around in the tank and dumped out. Repeat the process until the solvents come out clean and an inspection shows that there is none of the old sealant in the tank. Drain it completely, and dry the tank with compressed air.

5. Plug all the threaded holes with pipe plugs, and cover the gage hole with tape or a metal plate.

6. Pour about a gallon of sloshing or sealing compound into the tank, thinned as recommended on the can. Cover the filler hole, and slowly rotate the tank until every bit of the inside is covered. Leave the main line plug slightly loose to relieve pressure which builds up during sloshing.

7. Place the tank over a container and remove the quick drain plug. Allow as much compound to drain out as will. This compound will remain usable if it is covered immediately after draining it from the tank. If it has thickened, it can be thinned with ethyl acetate or methyl ethyl ketone and mixed thoroughly.

8. Reinstall the drain plug, and put on another coat by pouring a gallon of sealer in the tank and rotating the tank as before.

9. Drain and dry the tank for at least 24 hours; or if the air, under a pressure not exceeding 1½ psi, is circulated through the tank, it can be used after 16 hours.

10. Clean all of the threaded openings with a bottle brush and MEK or ethyl acetate, and install the fittings, using an appropriate thread lubricant.

11. Coat the float of the sender unit with vaseline or light grease to prevent its sticking to the compound, and reinstall the sender, using a new gasket and Permatex No. 2.

12. Reinstall the tank according to the manufacturer's recommendations and fill it with fuel. Check the operation of the sender, and free it from the bottom of the tank if it has stuck in the fresh sealer.

Never reseal a tank until every bit of the old material has been removed. No new material may be put in the tank if even a trace of the old material remains.

This type of sealant may be used around rivets and seams in built-up tanks if the area is perfectly clean and scrubbed with ethyl acetate or MEK—and the sealant brushed into the seams and around the rivets inside the tank. Brush it on to a thickness about the same as you would have from the two coats of sloshed sealant. Cure the sealant by flowing air through the tank for 12 to 24 hours. Use just enough pressure to keep air moving through the tank.

H. High temperature finishes

1. Engine enamel

This enamel has pigments that are colorfast under high temperatures. The special colors used by engine manufacturers are available in this mateiral. It is thinned with regular enamel reducer or toluol.

2. Heat-resistant aluminum paint

This material is especially designed to resist temperatures up to about 1200° F. It is used on exhaust systems and heater shrouds.

I. Rot inhibiting sealer

Organic materials such as aircraft woods are subject to fungus or mildew which destroys the strength of the fibers. A special alkyd resin having very low solids content is mixed with fungicidal materials, and wood structures may be treated with this before they are varnished. Large and intricate wood structures may be dipped into a vat of this material to be sure every portion is protected. This should dry at least 24 hours before covering it with spar varnish.

Rot inhibiting sealer, as with any fungicide or mildewcide is poisonous, but because of its extremely low toxicity, no special safety precautions are required for its use beyond adequate ventilation.

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TECHNICAL INFORMATION SUPPLEMENT #4 — Uses and Characteristics of Wash Primer and Zinc Chromate Primer

Wash Primer

High-volume production of all metal aircraft brought about the development of a primer which provides a good bond between the metal and the finish and which allows the topcoat to be applied after only about a half-hour cure. These primers can be used on aluminum, magnesium, steel, or fiberglass. Acrylic or enamel topcoats can be applied directly over the wash primer, but for maximum protection, such as required for seaplanes or agricultural aircraft, an epoxy primer should be applied over it.

When wash primer is applied over a properly cured conversion coating, the organic film of the wash primer bonds with the inorganic film and provides excellent adhesion between the topcoat and the surface. It also provides good protection for the metal.

Wash primer is a three-component material. Four parts of primer are mixed with one part of acid diluent and four parts of thinner and allowed to stand for twenty minutes to begin its curing action. Restir and spray on the surface. The viscosity is adjusted by the addition of more thinner in order to get the extremely thin film required, but never use more than eight parts of thinner to four parts of primer.

Wash primers should be applied with a film thickness of not more than 0.3 mil (0.0003 in. or 0.0076 mm). This can be determined by looking at the surface. A film of proper thickness will not nearly hide the surface, but will give a slight amber cast to the aluminum.

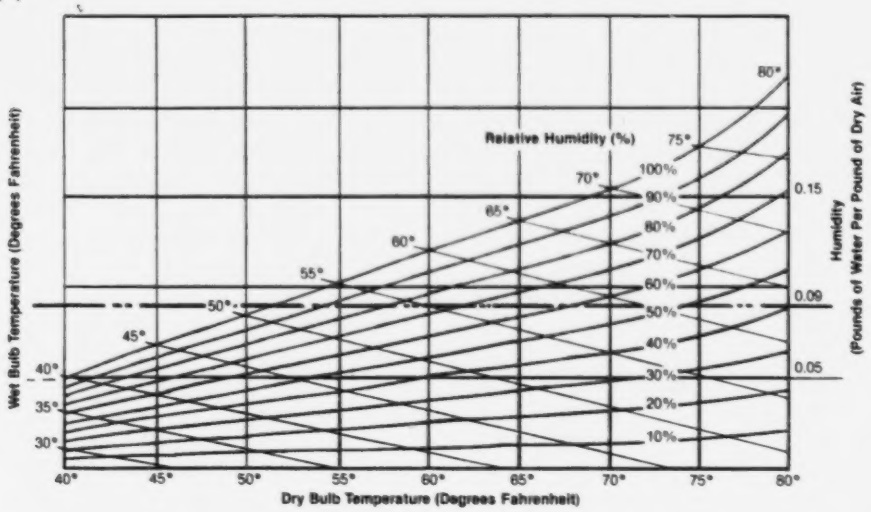
One of the main reasons wash primers are so popular for production is the fact that they may be topcoated in a short time after their application without the finish sinking in and losing its gloss. The acid requires about thirty minutes to convert into the phosphate film, so the topcoat must not be applied until the conversion has finished; but it must be applied within eight hours, or the glaze on the primer will be so hard that the topcoat will not adhere to it. Every effort should be made to topcoat wash primer within this time frame of one-half to eight hours; but if it is absolutely impossible to finish within this period, another coat of primer must be applied over this first one. Omit the acid when mixing the primer for the second coat and when it is going to be used over fiberglass or plastic.

About the most critical aspect of the application of wash primers is the necessity of having sufficient moisture in the air to properly convert the acid into the phosphate film. It has been proven by much research that proper conversion requires nine-hundredths of a pound of water

for every pound of dry air during the application of the primer. It is not really difficult to know exactly how much water is in the air if you refer to the chart in Figure 1. This is a modification of a relative humidity chart, and in order to use it, you must have two mercury thermometers.

EXAMPLE:

FIGURE 1

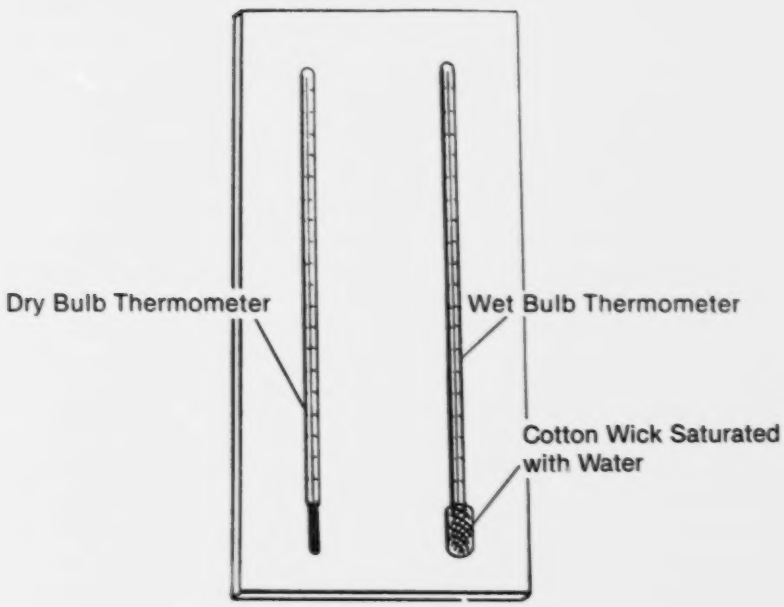


If the lines representing the wet bulb and dry bulb temperatures intersect above the 0.09 pound line, there is sufficient water in the air. If the intersection is between the 0.09 and 0.05 pound lines, one ounce of distilled water may be added to one gallon of the thinner. If the intersection is below the 0.05 pound line, a maximum of two ounces of distilled water may be added to each gallon of thinner to aid the cure of the primer.

Wrap a cotton wick around the bulb of one (See Figure 2), and, with the thermometers placed side by side in the spray booth, blow air from the spray gun across them. This will evaporate the water from the wick and lower the temperature measured on that thermometer. Locate the temperature of the thermometer without the wick (dry bulb) across the bottom of the chart in Figure 1, and follow this line up until it is crossed by the slanting line representing the temperature of the wet bulb thermometer. Read the amount of water on the horizontal line through this intersecting point. Let's assume, for instance, that the dry bulb temperature is 70°F and the wet bulb temperature is 60°F. These two lines cross above the horizontal line indicating 0.09 pound of water per pound of dry air, actually at about 0.095 pound. This means that there is enough water in the air to properly convert the acid in the primer.

EXAMPLE:

FIGURE 2



Saturate the wick surrounding the wet bulb thermometer with water, and blow air across the two thermometers. Locate the difference between the two readings on the chart in Figure 1 to determine the amount of water in the air.

If there is not enough water in the air for proper conversion, the finish will trap active acid against the metal. In order to prevent this, and the subsequent danger of corrosion, water may be added to the thinner. The thinner for wash primer is primarily an alcohol, and it will accept water. If there is somewhere between 0.05 and 0.09 pound of water to each pound of air, you may add one ounce of distilled water to each gallon of thinner. If there is less water than 0.05 pound per pound of dry air, you may add two ounces to each gallon of thinner; but this is the maximum amount permissible under any circumstances.

Acrylic laquer applied over an improperly cured wash primer is porous enough to allow moisture from a heavy dew to penetrate the film and unite with the free acid and convert it. In the process of doing this, the paint, primer and all, will be lifted from the surface in the form of blisters. If these blisters appear shortly after the painting has been finished, allow the airplane to sit in the sunshine and get thoroughly warmed. These blisters will go down, and the surface will be smooth again. The acid has now received sufficient water for its conversion, and the primer will have its proper cure; the finish has not been damaged, provided the condition was not initially too severe.

Another condition could exist within the wash primer if it is not sufficiently converted and is covered with an epoxy, or zinc chromate primer, or a polyurethane topcoat. These finishes are not as porous as acrylics and will not allow sufficient water to enter to complete the conversion but will allow enough to penetrate to react with the acid and the metal to form filiform corrosion. This is simply corrosion having a thread-like form in which the acid and water have reacted with the metal and formed a salt, destroying the metal. Once filiform corrosion is detected under any of the films, all of the finish must be stripped and the entire surface treated to remove every trace of the corrosion.

Zinc Chromate Primer

MIL-P-8585 zinc chromate primer is just about one of the best-known finishing materials used by A & P technicians. Its familiar green or yellow is "what airplane primer is supposed to look like." This has been the attitude for years, but it is losing ground now to the faster wash primers with their better adhesion or to the far more durable epoxy primers. Zinc chromate is still a good primer as far as corrosion resistance is concerned, but it is inferior to the others with regard to adhesion. Where it is desired to use zinc chromate, it can be effectively sprayed over a surface which has been properly treated with a conversion coating such as Alodine. The Alodine provides for the adhesion, so the corrosion-inhibiting qualities of the zinc chromate can be used.

Zinc chromate is held in an alkyd resin. This does not produce an absolutely tight surface but allows a small amount of water to enter the film and free some of the chromate ions, preventing, or at least inhibiting, the formation of corrosion on the surface it protects. It may be thinned for spraying with a proprietary thinner or with toluol.

Zinc chromate is available in both the familiar yellow and green colors. The primers are the same except for a touch of black pigment put into yellow primer to make it green. Red iron oxide may be added to zinc chromate primer to produce a hard, tough, protective film.

While zinc chromate has wide usage as a primer for both aluminum and steel, it does have some limitations. It should not be applied over a wash primer, unless you are absolutely sure all of the phosphoric acid has been converted into the phosphate film. The zinc chromate primer will tend to entrap water and allow the formation of filiform corrosion. Zinc chromate should not be used as a base coat for acrylic lacquers, as the solvents in the acrylic will lift the zinc chromate unless it has aged for several days.

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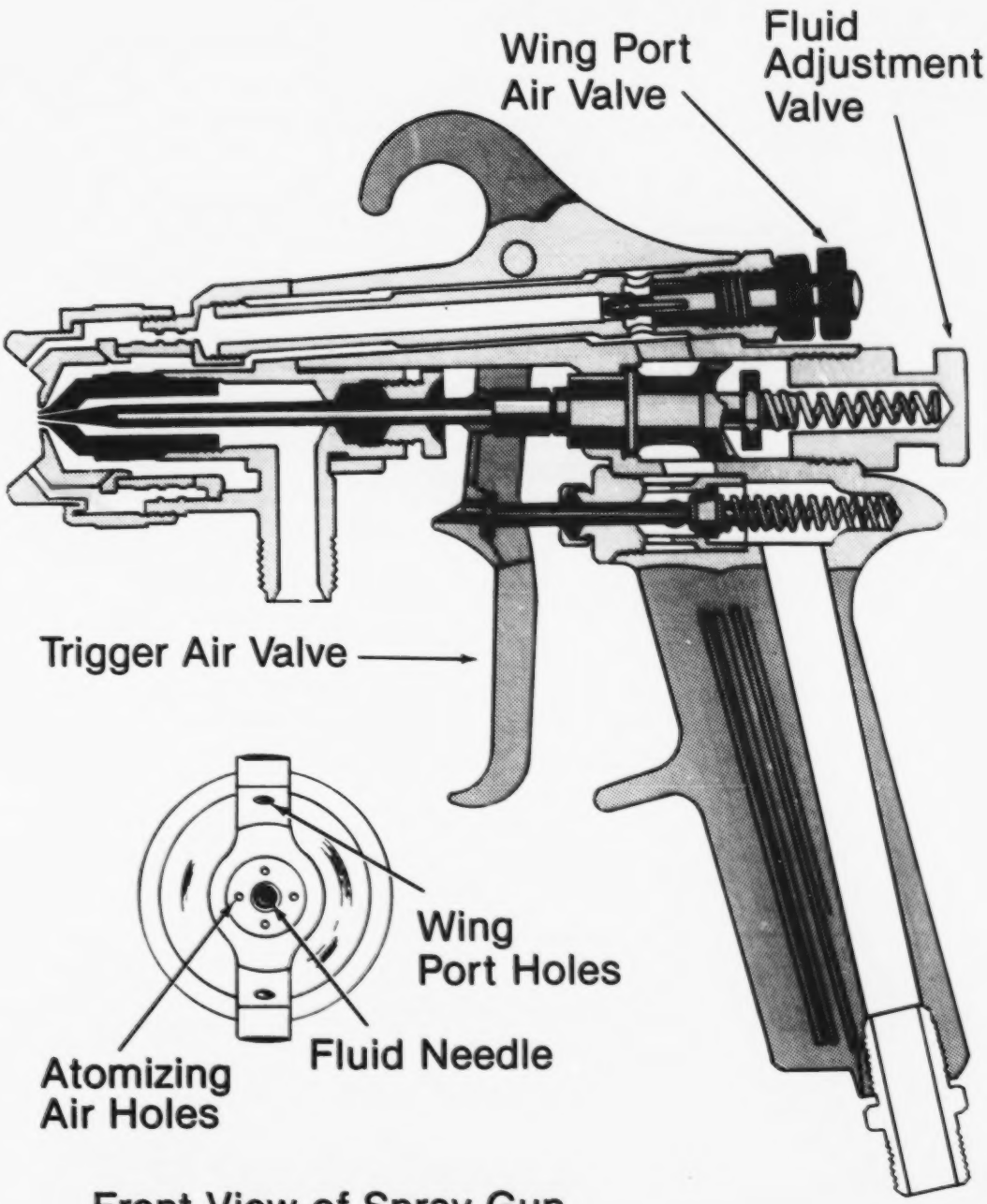
Parts of a Spray Gun



Front View of Spray Gun

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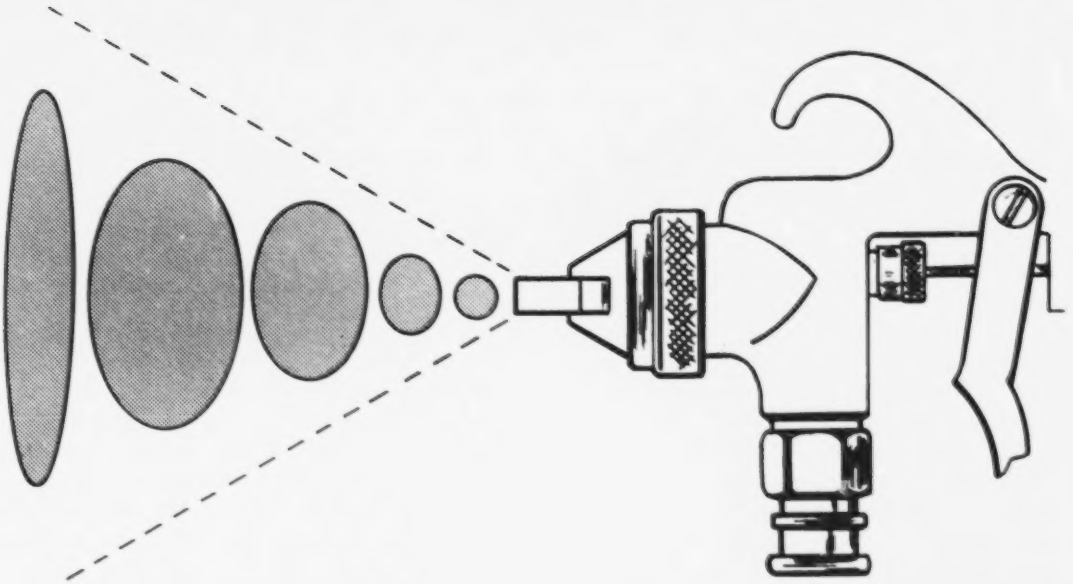
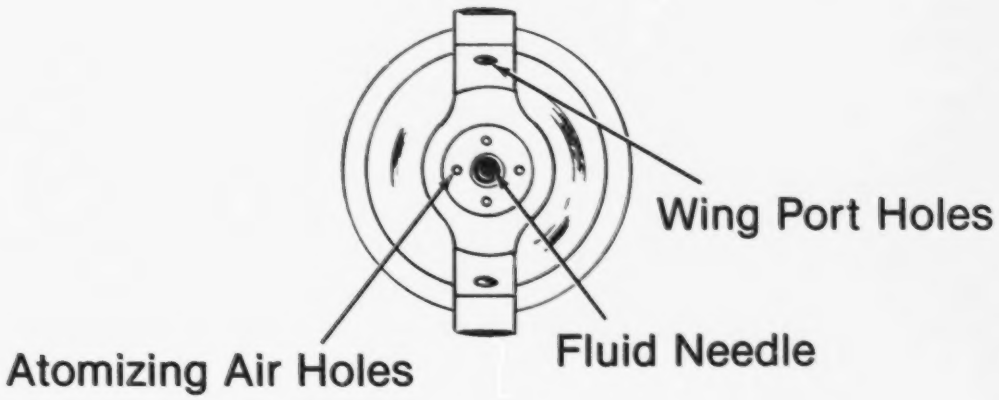
Adjusting the Spray Pattern



Spray pattern flattens as airflow from wing port holes increases.



Front View of Spray Gun

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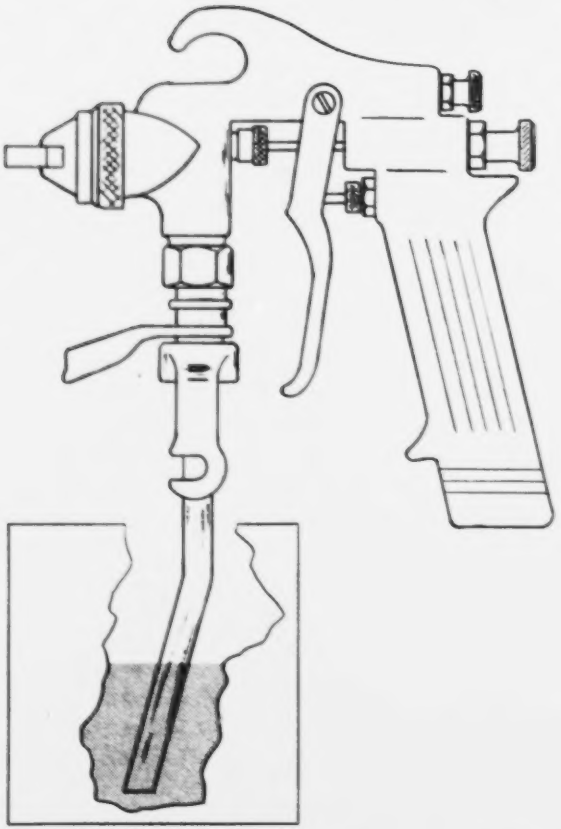
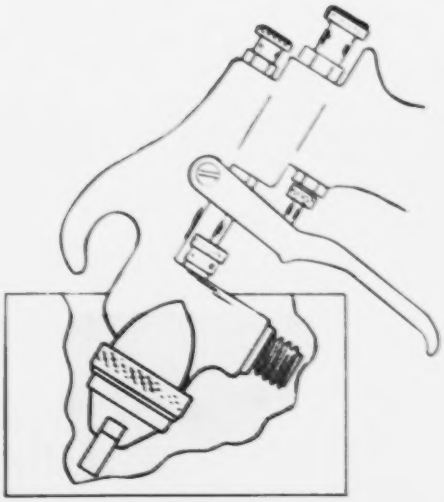
Cleaning a Spray Gun



Spraying Thinner Through Gun



Soaking Nozzle

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Paint Spray-Pattern Defects

Normal Spray Pattern

Insufficient Atomizing Air Pressure

Excessive Atomizing Air Pressure

Material Buildup Around One Side of Fluid Nozzle

One Wing Port Hole Plugged

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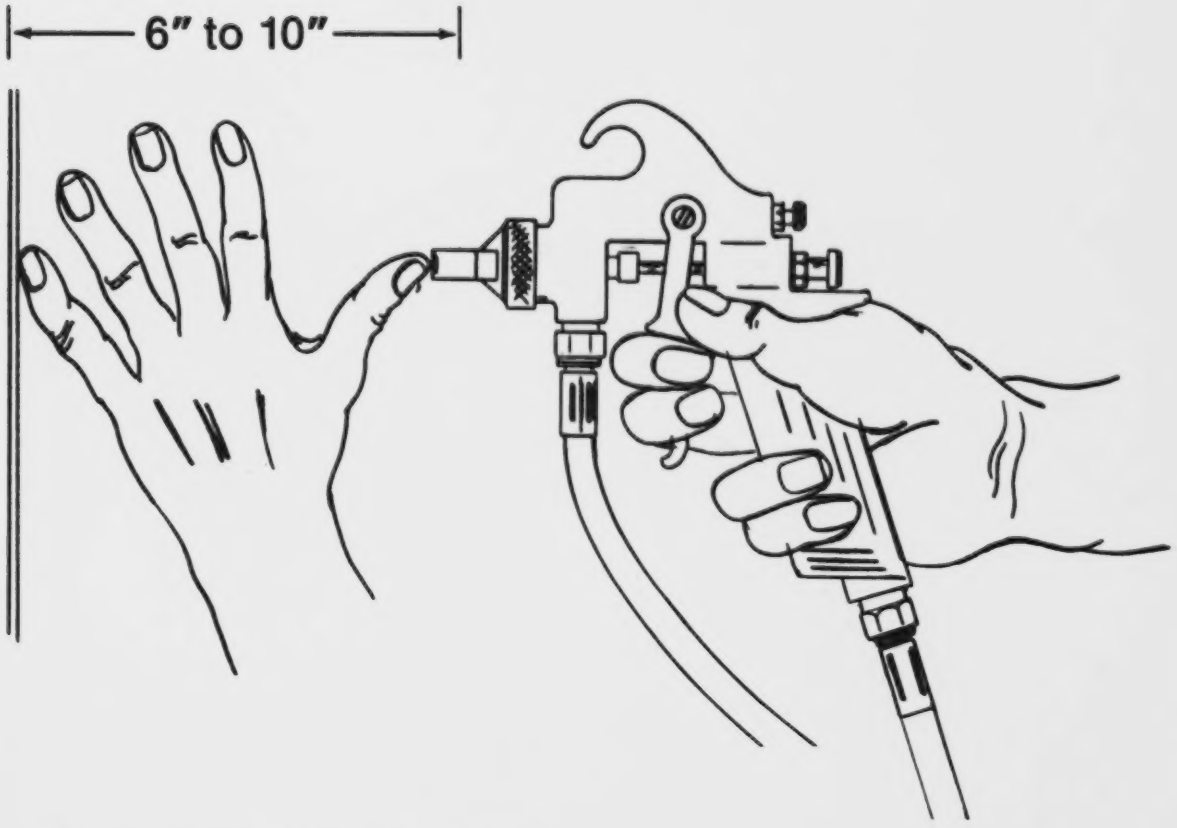
A203B-39

TM #4

Spraying Techniques

Proper Spray Distance



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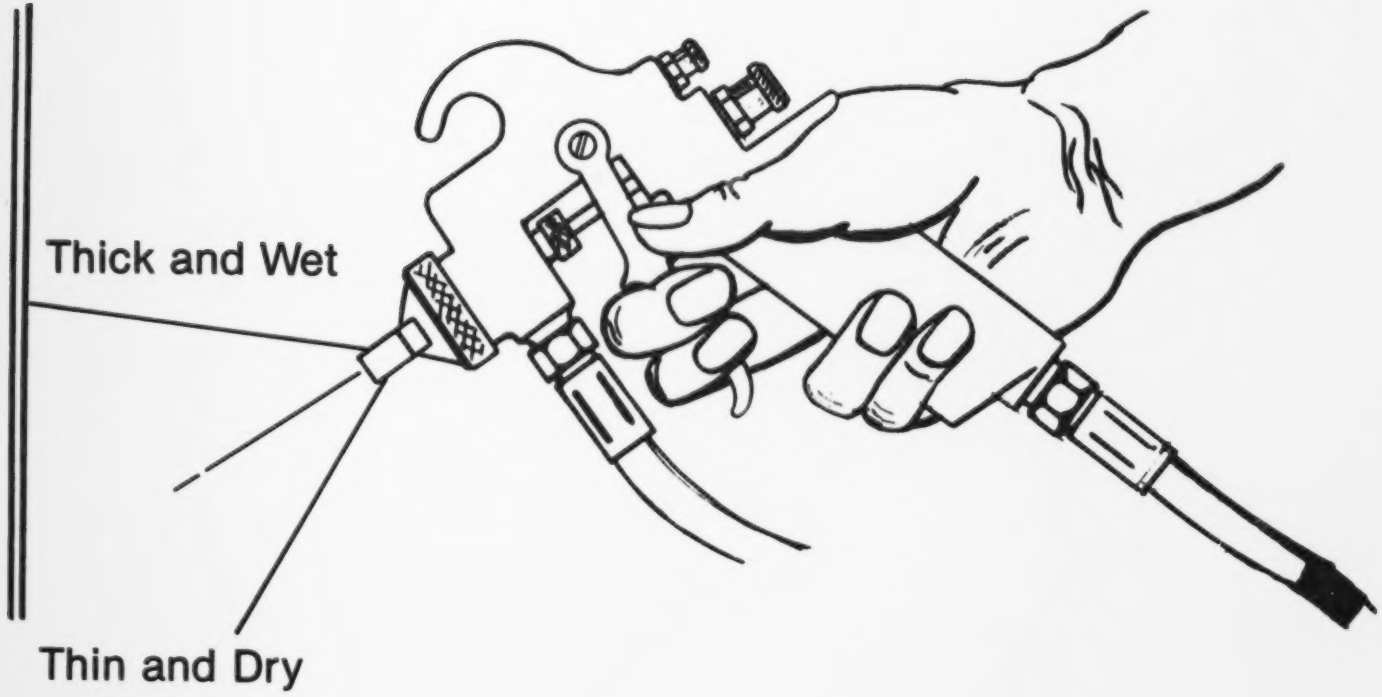
Spraying Techniques
(Continued)

Incorrect Position of Spray Gun



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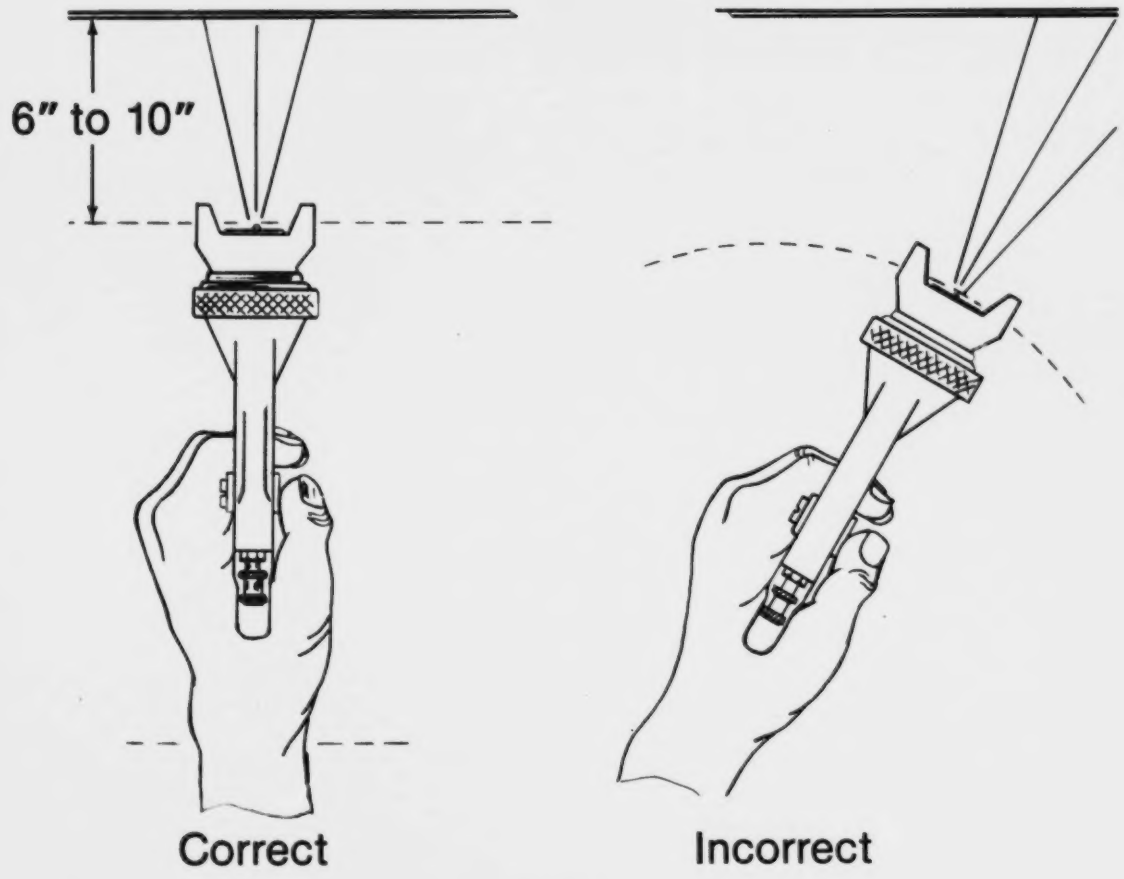
TM #6

Spraying Techniques
(Continued)



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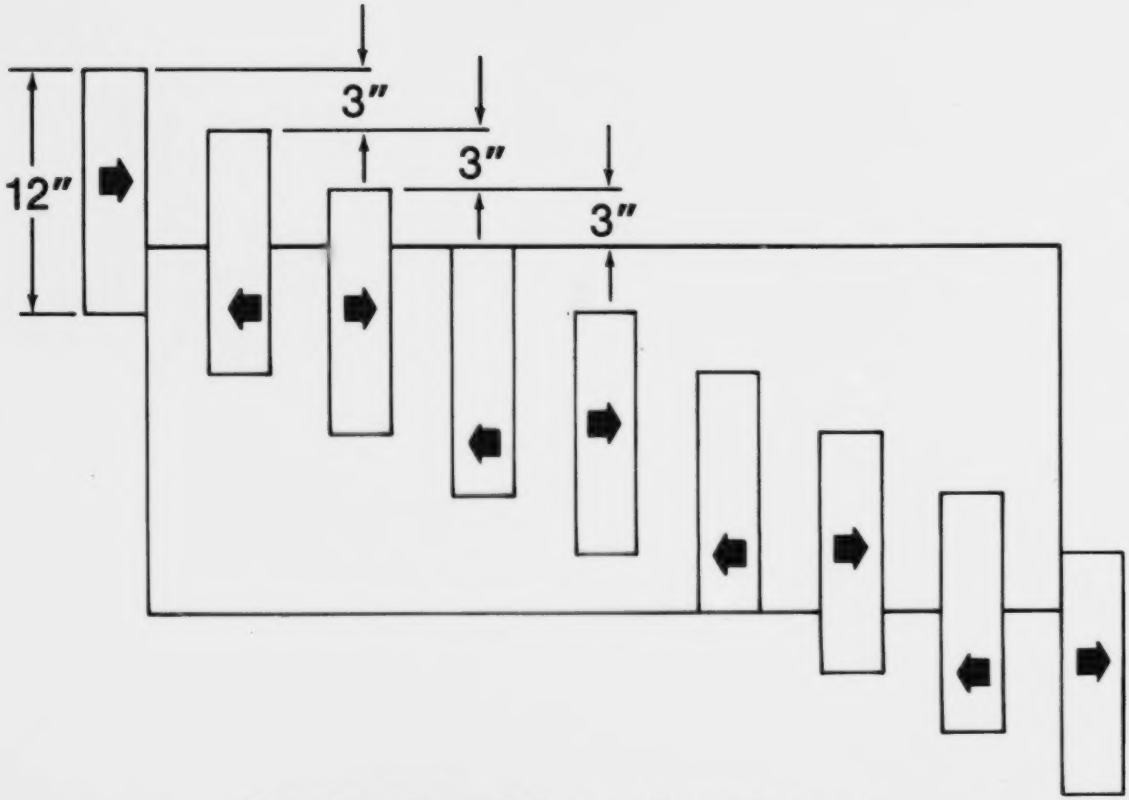
Spraying Techniques
(Continued)



Overlap two-thirds of each pass.

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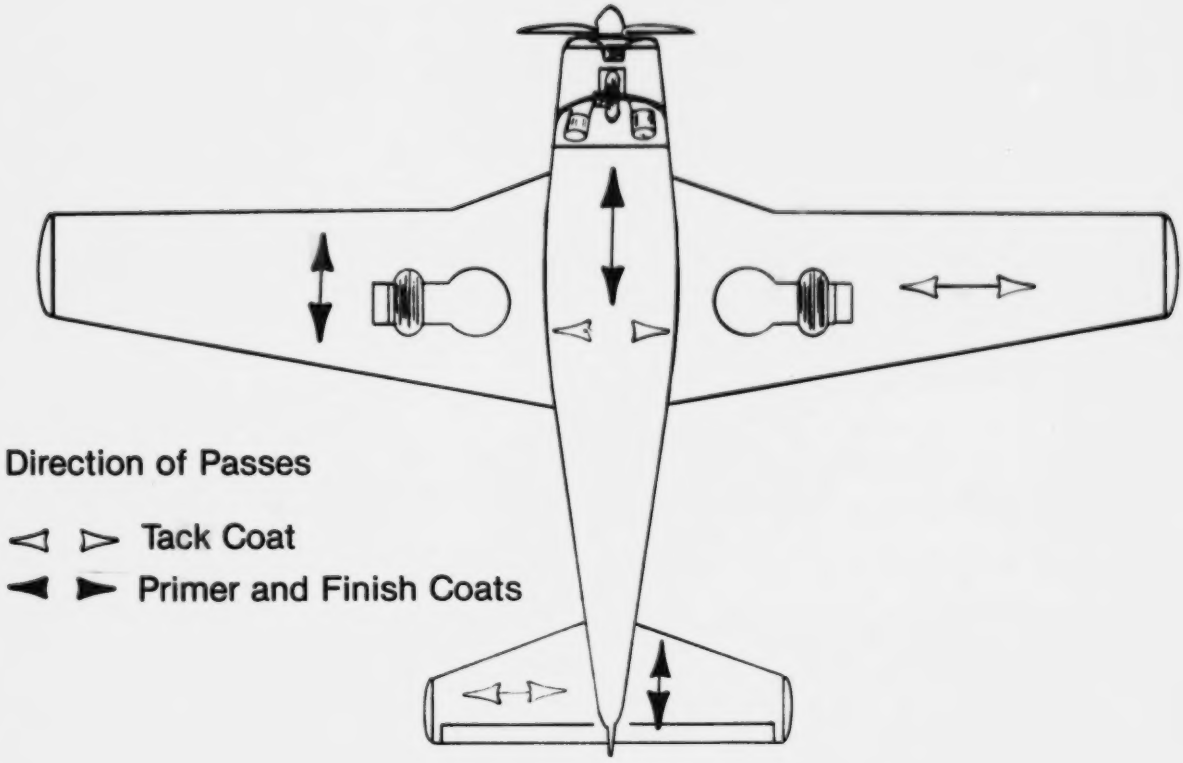
Spraying Sequence

1. Bottom of Airplane



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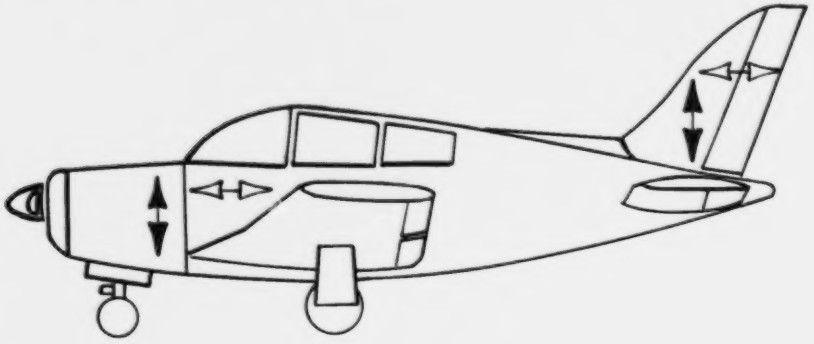
Spraying Sequence
(Continued)

2. Side of Airplane



Direction of Passes

◁ ▷ Tack Coat

◀ ▶ Primer and Finish Coats

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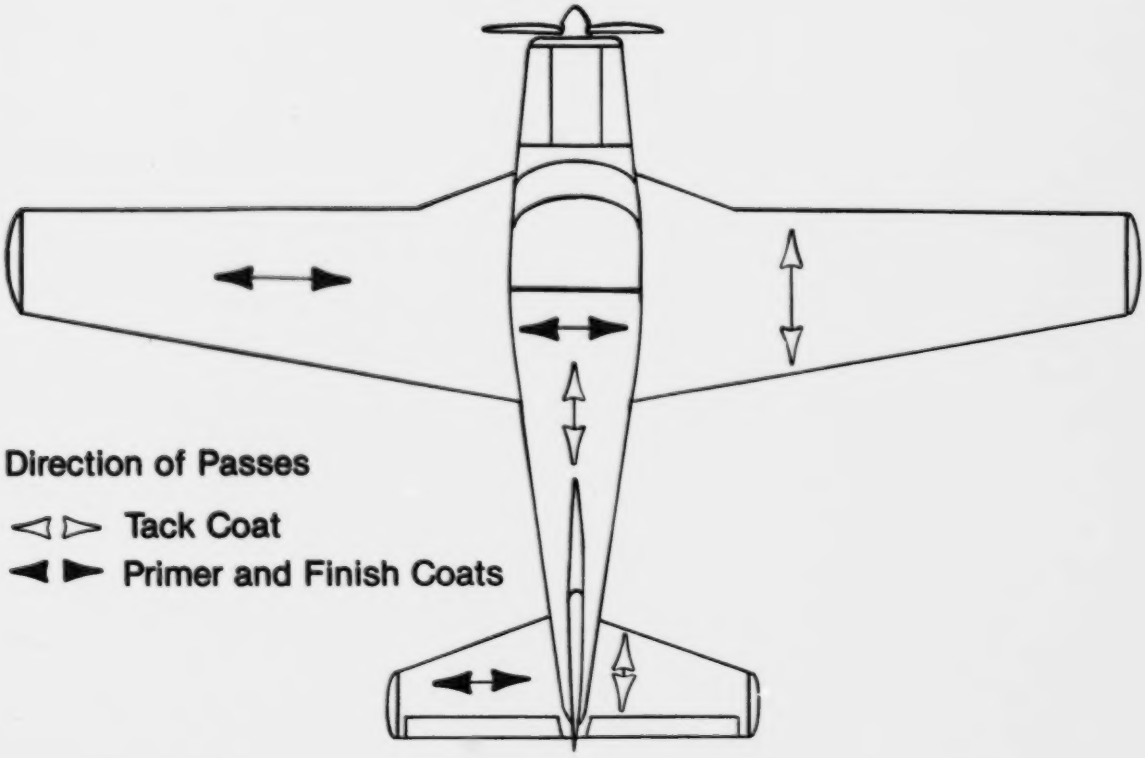
Spraying Sequence
(Continued)

3. Top of Airplane



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PROJECT GUIDE #1 — Finish a Fabric-Covered Surface

PURPOSE: To allow you to develop skill in preparing a fabric-covered surface, in finishing the setup of and using spray painting equipment, and in the processes involved in finishing a fabric-covered surface.

REFERENCE MANUALS:

A. EA-ITP-AB

B. AC 65-15A

C. *Stits Poly-Fiber Covering & Painting Manual*

EQUIPMENT AND TOOLS:

A. Suction-cup spray gun

B. Iron, 1100 watts minimum

C. 60-watt light bulb and socket

D. 1-gallon bucket

E. Appropriate personal safety devices and protective clothing

F. Respirator (approved canister-type or air-line-type)

SUPPLIES AND MATERIALS:

A. Fabric-covered control surface

B. Two paint strainer cones (60 x 48 or finer mesh)

C. 9" x 11" sheet of 3M 280-grit wet or dry sandpaper

D. 9" x 11" sheet of 3M 400-grit wet or dry sandpaper

E. Aluminum foil (enough to cover surface of project)

F. Poly-Tone (shop supply)

G. Poly-Spray (shop supply)

H. Tack rags

I. Clean rags

J. Thinner (shop supply)

PROCEDURE:

CAUTION

Always wear a respirator when applying any finishing material with the paint sray gun.

A. Filtering Poly-Spray through mesh paint strainer cone to eliminate lint, fill spray gun suction cup (Figure 3)

FIGURE 3

B. Attach air-pressure hose to spray gun

C. Adjust spray gun pressure at air-pressure system regulator to approximately 45 psi

D. Position spray gun 8 inches from test panel, and spray several strokes across panel to check for smooth flow-out (See Figure 4)

(NOTE: Smooth flow-out indicates proper viscosity. If further thinning of Poly-Spray is necessary to obtain proper viscosity, consult the *Stits Poly-Fiber Covering & Painting Manual*, page 18, Step 10, "First Coat of Poly-Spray.")

FIGURE 4

E. Check spray pattern on panel for proper shape

(NOTE: A properly adjusted spray gun should produce a uniform, fan-shaped spray with the fan shape being perpendicular to the wing ports.)

F. Adjust spray gun and viscosity as required until proper flow-out and pattern are achieved

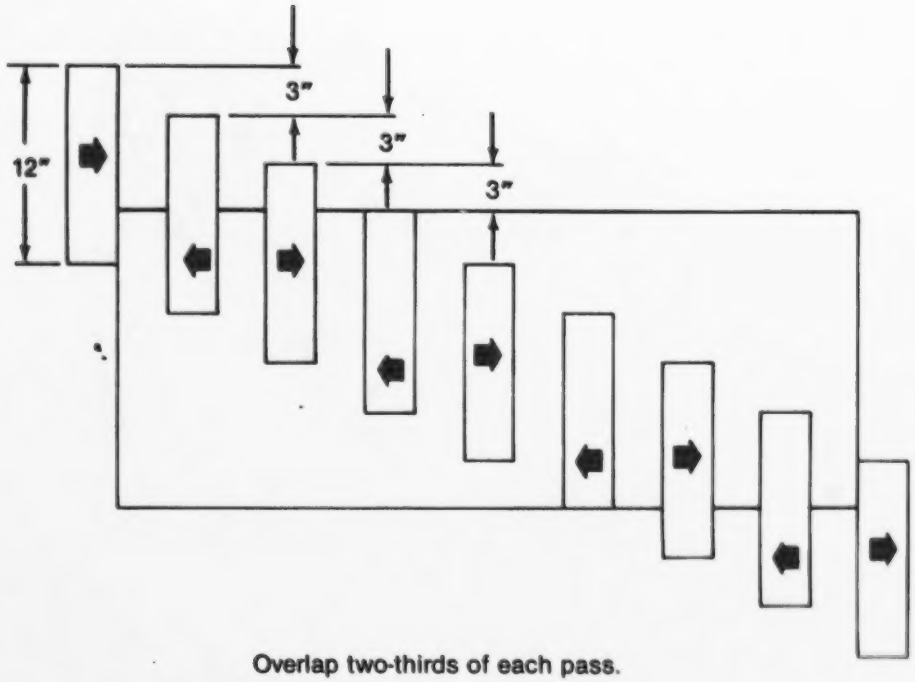
G. Starting with edges and corners, spray fabric-covered control surface with Poly-Spray

(NOTE: Remember to keep wrist stiff while spraying. If any spraying problems such as blushing, orange peel, sags, runs, etc., are encountered, refer to AC 65-15A, page 124, or EA-ITP-AB, page 176.)

1. Holding spray gun 8 inches from panel, begin each pass away from surface, pulling spray-gun trigger just before reaching edge of surface and releasing trigger after passing opposite edge of surface

2. Make additional passes, overlapping each pass by all but 2 to 3 inches, until entire surface has been covered (See Figure 5)

FIGURE 5



Overlap two-thirds of each pass.

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H. Allow Poly-Spray to dry

I. Place aluminum foil over Poly-Spray surface

(NOTE: Any wrinkles in the aluminum foil should be smoothed first by placing aluminum foil over cardboard and ironing out wrinkles.)

J. Use iron to iron wrinkles or loose edges of finishing tape (See Figure 6)

CAUTION

Keep iron on foil-covered area. Do not use the iron directly on the surface of the panel as this will damage the Poly-Spray coat.

FIGURE 6

K. Remove aluminum foil

(NOTE: If the aluminum foil sticks to a fresh surface, reheat to peel it off.)

L. Thoroughly inspect Poly-Spray surface, and note all coating flaws, loose tape, pinholes

M. Perform touchups in accordance with *Stits Poly-Fiber Covering & Painting Manual*

N. Repeat Step G to apply second, heavy coat of Poly-Spray

(NOTE: This heavy coat is necessary to provide a good base for sanding.)

CAUTION

Do not attempt to sand surface until after the second coat has been applied and allowed to dry. The first coat is very thin, and the fabric filaments are likely to be damaged and the finishing tape could be cut if sanding is done before a second coat is applied.

O. Allow second coat of Poly-Spray to dry

(NOTE: Drying time will be from 30 minutes to 2 hours, depending on the temperature and the humidity.)

P. Wet sand surface with 3M 280-grit wet or dry sandpaper or equivalent (Figure 7)

(NOTE: Sand the surface only enough to develop a smooth surface on the Poly-Spray; do not sand any further or fabric damage will occur. Do not break the finish by sanding over screw heads, rib lacing, or any other sharp edges.)

CAUTION

Under certain humidity conditions, the sanding process can create static electric charges which could ignite fresh solvent vapors in the area causing an explosion. Grounding the structure being sanded reduces the chances of such an explosion and also keeps lint and dust from being attracted to the surface.

FIGURE 7

Q. Wash sanding residue from surface with running water

(NOTE: Remove sanding residue while the surface is still wet from sanding. Do not allow the surface to dry before removing sanding residue because wiping the surface after it has dried will leave a powder.)

R. Allow surface to dry, then wipe surface with tack rag (Figure 8)

FIGURE 8

S. Repeat Step G to apply third coat of Poly-Spray

(NOTE: Do not sand the surface after the third coat.)

T. Clean spray gun immediately after spraying final coat of Poly-Spray

1. Remove any remaining spray material from suction cup
2. Partially fill suction cup with thinner, and spray thinner through gun repeatedly until thinner comes out with no trace of spray material

(NOTE: This will flush the passageways and clean the tip of the needle.)

3. Soak nozzle in container of thinner until all traces of spray material have been removed

CAUTION

Do not soak the entire gun in the thinner as this will ruin the packings.

U. Check for ultraviolet light penetration

CAUTION

A loose connection, resulting from an incandescent light bulb not tightened properly in a socket, near the structure could ignite fresh solvent vapors and cause an explosion.

1. Hold a 60-watt light bulb near inspection hole in fabric (See Figure 9)
2. Check for light penetration on opposite side of panel (Figure 9)

FIGURE 9

V. Check Poly-Tone to make sure pigments have not settled in can

(NOTE: If pigments have settled in the can, use a double-action paint shaker to disperse them. Use a paint stirring stick to dislodge any pigments stuck to the inside of the can being careful not to scrape away any of the phenolic lining inside the can.)

W. Filtering Poly-Tone through mesh paint strainer cone to eliminate lint, fill spray gun suction cup

X. Repeat Steps D through F to adjust spray gun and Poly-Tone viscosity

(NOTE: If further thinning of Poly-Tone is necessary to obtain proper viscosity, consult the *Stits Poly-Fiber Covering & Painting Manual*, page 19, Step 14, "Thinning.")

Y. Wipe Poly-Spray surface with clean, dry tack rag to remove any lint and dust

Z. Repeat procedures in Step G to apply first coat of Poly-Tone

(NOTE: Do not spray in direct sunlight, in a strong draft, or in the wind. The fresh coat must remain wet for a few minutes to allow flow-out and to provide a smooth, glossy finish.)

AA. Allow Poly-Tone to dry a minimum of 2 hours

(NOTE: Poly-Tone will dry dust-free in 10 to 15 minutes with a temperature of 70°F and a relative humidity of 50 percent. However, it is sensitive to finger pressure up to one hour after spraying.)

BB. Lightly wet sand Poly-Tone surface with 3M 400-grit or finer wet or dry sandpaper

CC. Wash sanding residue from surface with running water

DD. Dry surface by wiping with clean rags

EE. Remove lint and dust particles using clean, dry tack rags

FF. Repeat procedures in Step G to apply second coat of Poly-Tone

CAUTION

Do not sand second coat of Poly-Tone.

GG. Repeat Step T to clean spray gun and suction cup

HH. Clean work area, and return tools and equipment to proper storage area

Procedure in this project guide adapted with permission of Stits Aircraft, from *Stits Poly-Fiber Covering & Painting Manual*, Procedure Manual No. 1, rev. 13, Jan. 1983, 2nd ed., by Ray Stits.

PROJECT GUIDE #2 — Apply Registration Letter to Finished Surface

PURPOSE: To allow you to develop skill in the layout, masking, and application of trim (registration letters and numbers) on a finished surface.

REFERENCE MANUAL: EA-ITP-AB

EQUIPMENT AND TOOLS:

A. Straight-cut aviation snips

B. Ruler

C. Scissors

D. Appropriate personal safety devices and protective clothing

E. Respirator (approved canister-type or air-line-type)

SUPPLIES AND MATERIALS:

A. Fabric-covered control surface used in Project Guide #1

B. Polypropylene tape

C. Crepe masking tape

D. Masking paper

E. Soft-lead pencil

F. One can of spray paint

G. 2" x 14" piece of thin aluminum (with corners square)

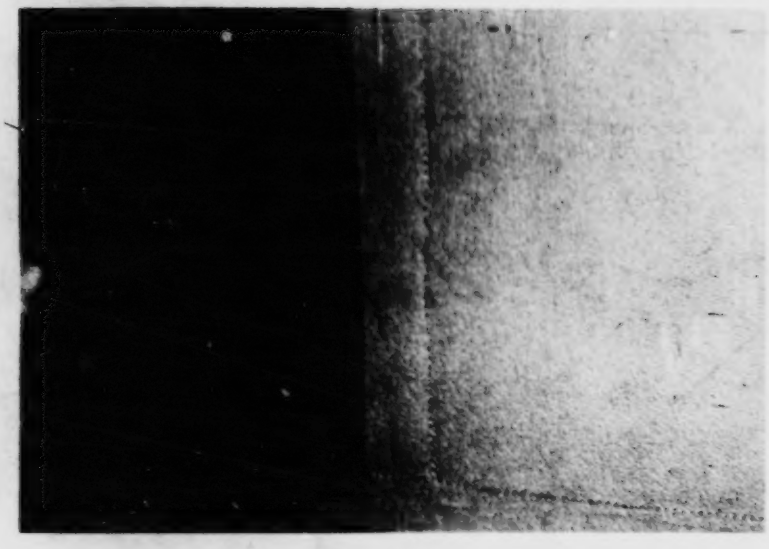
PROCEDURE:

A. Fabricate layout tool from aluminum according to Fig. 3-58 in EA-ITP-AB, page 186

(NOTE: Be sure all sharp edges are removed from the tool before using.)

B. Centered on control surface and perpendicular to spar, apply to frame two strips of polypropylene tape 12 inches apart (See Figure 10)

FIGURE 10



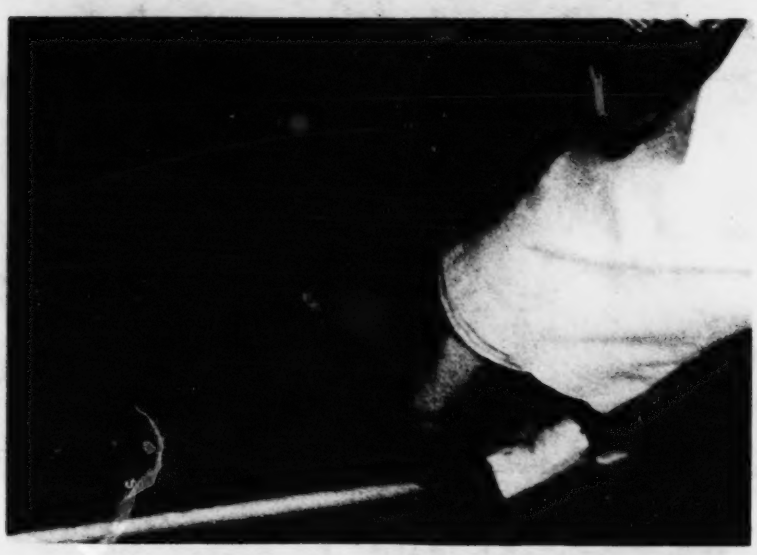
C. Using layout tool and soft-lead pencil, mark layout lines for letter between polypropylene tape strips (Figure 11)

(NOTE: Use the first letter of your last name.)

FIGURE 11

D. Mask inside and outside edges of letter with polypropylene tape (Figure 12)

FIGURE 12



E. Mask any holes in letter with crepe masking tape and masking paper (Figure 13)

FIGURE 13

F. Mask edges of letter block with masking paper (See Figure 14)

FIGURE 14

G. Check work carefully to see that all areas not to be painted are masked properly and that areas to be painted are not masked

H. Spray prepared area with paint (Figure 15)

CAUTION

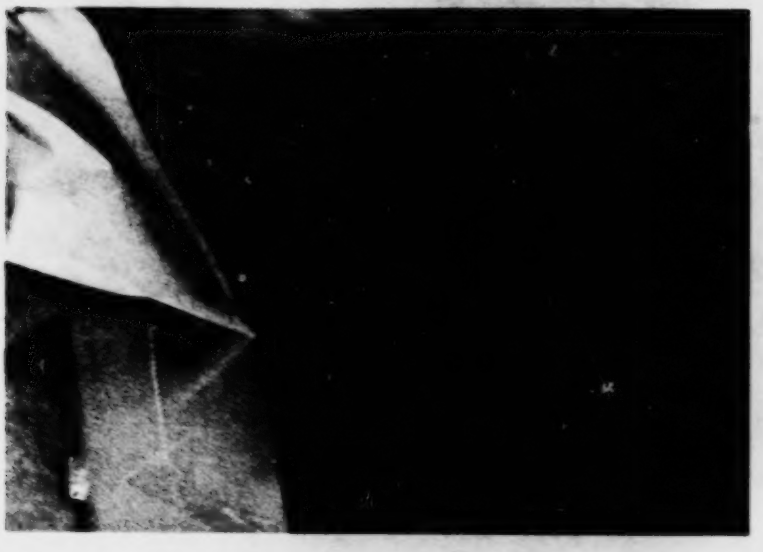
Make sure that work area is properly ventilated.

FIGURE 15

I. Allow paint to dry until tacky

J. Remove masking tape and paper from outside edges of letter (Figure 16)

FIGURE 16



K. Remove polypropylene tape from outside edges of letter (Figure 17)

FIGURE 17

L. Remove crepe masking tape, masking paper, and polypropylene tape from center of letter (Figure 18)

FIGURE 18

M. Check to see that edges of letter are sharp and clean (Figure 19)

FIGURE 19

N. Clean work area, and return tools and equipment to proper storage area

AIRFRAME
A203 AIRCRAFT FABRIC COVERING, PAINTING, AND FINISHING
APPLY DOPE, PAINT, AND TRIM
A203-B

THEORY TEST

1. Match terms related to aircraft finishing materials and equipment to their correct definitions. Write the correct numbers in the blanks.

_____a. Paint gun in which the material is held in a cup attached to the gun and is drawn into the atomizing air by suction created by the atomizing airflow

_____b. Metric term meaning 1/1000 inch

_____c. Attachment of one material to another or of a finish to the metal or fabric

_____d. Paint spray gun in which the material is fed to the gun by air pressure on the pot or cup holding the material

_____e. Defect in a finish which appears as a tiny hole

_____f. Constituent of wash primer that provides a mild etch to the surface of the metal for a better bond

_____g. Special cup of definite size and shape with a hole in its bottom; used to measure viscosity of a material

_____h. Two-part, catalyzed material used to provide a good bond between a surface and the topcoat

_____i. Material whose pigments are suspended in a vehicle which cures by conversion of some of its solvents by heat, oxidation, or catalytic action

_____j. Restoring of resilience to a dope film by opening up the film with potent solvents and allowing the plasticizers in the rejuvenator to replace those which have migrated from the dope

_____k. Constituent of a conversion coating which microscopically roughens the surface of metal being treated and deposits a phosphate film

1. Pressure-fed gun
2. Acid diluent
3. Enamel
4. Mil
5. Zahn cup
6. Suction-cup gun
7. Rejuvenation
8. Pinhole
9. Bond
10. Epoxy primer
11. Phosphoric acid etchant

_____l. Fault in a finish resembling a haze

_____m. Solvent mixed with a paint material to reduce its viscosity

_____n. Drying of a finish to touch by the evaporation of certain of the solvents

_____o. Chemical change which takes place in a finishing system which produces the desired surface

_____p. Container holding the material to be sprayed

_____q. Polymerized film used as a topcoat system for aircraft finishing

_____r. Chemical solution used to form a dense, nonporous oxide or phosphate film on the surface of aluminum or magnesium alloys

_____s. Very light coat of material sprayed on a surface and allowed to set until the solvents evaporate

_____t. Hard, smooth surface of a finishing system

_____u. Condition in the application of dope in which the surface dries while the dope is being brushed

_____v. Circular pattern of cracks in a brittle dope finish that results when a blunt object presses against the fabric

_____w. Thread- or filament-like corrosion which forms on aluminum skins beneath polyurethane enamel

_____x. Aircraft finish consisting of an acrylic resin vehicle and certain volatile solvents

_____y. Sandwiching material which provides a mild etch to the metal surface and a good bond for the topcoats

_____z. Very light spray coat of thinner or other volatile solvent with little or no color in it

_____aa. Agent which causes a chemical reaction within the solution

12. Ringworms
13. Polyurethane
14. Air impingement
15. Conversion coating
16. Glaze
17. Cure
18. Filiform corrosion
19. Flashing off
20. Dope roping
21. Pressure pot
22. Tack coat
23. Thinner
24. Wash primer
25. Catalyst
26. Acrylic lacquer
27. Mist coat

_____bb. Material which provides a sandwich between the topcoats and the metal to provide a good bond

_____cc. Application of a material to a surface by a spray gun in which the material is fed in a solid stream rather than in tiny droplets

_____dd. Coat of dope with some of its thinner replaced with retarder, sprayed on a blushed area to attack and reflow the surface and remove the blush

_____ee. Rag, slightly damp with thinner, used to wipe a surface after it has been sanded to prepare it for the application of the next coat of finish

_____ff. Time period after catalyzed material is mixed in which the material is allowed to begin its cure before it is sprayed onto the surface

_____gg. Second coat of paint sprayed at a 90-degree angle to the direction of the first coat of paint before the first coat flashes off

_____hh. Slow-drying solvent used to prevent blushing or to provide a more glossy finish by allowing the material a longer flow-out time

_____ii. Isolated areas on a surface which have rejected the finish because of wax or silicone contamination

_____jj. White or grayish cast which forms on a lacquer or dope film which has been applied under conditions of too high humidity

_____kk. Powder or paste mixed with a finish to give the desired color

_____ll. Paint which will not be softened or lifted by dope

_____mm. Constituent of dope used to provide resilience to the film

28. Tack rag
29. Retarder
30. Nonatomizing spray
31. Cross-coat
32. Primer
33. Burn-down coat
34. Induction period
35. Dope-proof paint
36. Blushing
37. Plasticizer
38. Fish eyes
39. Pigment

2. State safety precautions related to handling and storing aircraft finishing materials by answering the following questions.

   a. Why should finishing materials never be stirred with a beater turned by an electric drill motor?

_____

_____

b. What should be done if finishing materials catch fire while mixing them?

_____

_____

c. 1) What should be done if finishing material should enter your eyes?

_____

_____

2) How could such an accident be prevented?

_____

_____

d. Why should an aircraft structure be electrically grounded, especially if the first coats of finish are nitrate dope?

_____

_____

_____

e. 1) Should a dry broom be used to sweep overspray from the paint room or hanger floor?

_____

2) Why or why not?

_____

_____

3. State the drawback of the traditional dope finish which has caused refinishers to consider newer systems.

_____

_____

_____

_____

4. Select true statements related to dope rejuvenation. Write an "X" in the blanks before the correct answers.

_____a. Begin rejuvenation by cleaning the old finish with a Scotch-Brite pad using butyrate dope thinner

_____b. To remove any wax, scrub the old finish with a rag dampened with toluol or MEK (methyl ethyl ketone)

_____c. Rejuvenator is essentially a mixture of potent solvents and plasticizers; the solvents soften the dried dope film and keep it open long enough for the plasticizers to become part of the film

_____d. The first coat of rejuvenator should not cause the fabric to loosen

_____e. Because of the initial application of aluminum pigmented dope, a reapplication of aluminum dope is not required after rejuvenating a surface

5. Discuss the finishing process in relation to the application of dope by answering the following questions.

a. The finishing coats of dope should be sprayed on as heavily as possible in order to fill the weave and produce a smooth finish. If too much dope is applied, what type of finishing defect can result?

_____

b. In order to build a film with a minimum number of coats using a minimum amount of thinner, what type of spray equipment is preferred?

_____

c. What can be done to the final coat of pigmented dope to obtain a glossier finish?

1) _____

_____

2) _____

_____

d. If clear dope is mixed with pigmented dope for the final coat, why should the clear dope be limited to only 20 percent?

_____

_____

_____

_____

6. Match the following finishing problems to their causes. Write the correct numbers in the blanks.

_____a. Caused by applying too much dope by moving the spray gun too slowly, holding the spray gun too close to the work, or by applying dope that is not thinned properly

_____b. Caused by the surface drying while the dope is being brushed; results in a stringy, uneven surface

_____c. Results when nitrate dope is sprayed over butyrate dope or when too much aluminum powder is mixed in aluminum dope

_____d. Caused by bubbles breaking through the surface of dope which has prematurely hardened; the hardened surface cannot flow back and cover these areas

_____e. Caused when isolated areas reject the finish because of wax or silicone contamination on the surface

_____f. Caused by nitrocellulose precipitating from the finish, leaving it porous; appears as a white or grayish cast which forms on a lacquer or dope film which as been applied under conditions of too high humidity

_____g. Caused by the surface of the dope drying before the dope below the surface dries; when the subsurface dope dries, it wrinkles the surface. Results from spraying with excessive pressure, drafts over the surface, or using drying thinner that evaporates too quickly

1. Poor adhesion
2. Blushing
3. Pinholes
4. Sags and runs
5. Orange peel
6. Fish eyes
7. Dope roping

7. Select true statements concerning the use of a polyurethane finish on a fabric-covered airframe. Write an "X" in the blanks before the correct answers.

_____a. Polyurethane finishes on fabric-covered aircraft have been criticized because they tend to crack as the fabric flexes beneath them

_____b. If a fabric surface ever needs to be patched, polyurethane topcoats are repaired more easily than dope topcoats; this is considered a definite advantage

_____c. Newer polyurethane topcoats are formulated to produce a flexible film which does not crack when sprayed over fabric and should be used with special flexative-modified primers

_____d. Aluminum dope is absolutely necessary to protect the synthetic fabric from harmful ultraviolet rays; it should be applied after the fabric is filled and just before the primer is applied

_____e. When fabric repairs are necessary, polyurethane topcoats may be removed by sanding down to the clear dope coats

8. Match special finishes and finishing products to their uses. Write the correct numbers in the blanks.

_____a. Special sharp-grain sand mixed into a tough enamel material used to form nonslippery surfaces on airplanes

_____b. Asphaltum product used to provide protection from abrasion

_____c. Coat of transparent pigment, applied over a white, reflective base coat, used to make aircraft more visible

_____d. Resilient, nonhardening sealer used to seal around rivets and seams

_____e. Material used in areas considered to be prone to corrosion because of the presence of acid fumes and occasional acid spills

_____f. Durable, nonreflective coating used for instrument panels and glare shields

_____g. Finish used for surfaces subject to considerable rough treatment

1. High visibility finishes
2. Wrinkle finish
3. Flat black lacquer
4. Wing walk compound
5. Acid-proof paint
6. Float bottom compound
7. Fuel tank sealer

9. Match paint finish identification tests to test results. Write the correct numbers in the blanks. Some questions may have more than one answer, and some answers may be used more than once.

_____a. Old nitrocellulose finishes will soften within a period of a few minutes

_____b. Pigment from an acrylic finish will be picked up

_____c. Epoxy coating will not be affected

_____d. Acrylic and epoxy finishes will not be affected

_____e. Fluorescent finishes will become apparent

1. Wipe down a small area of the surface in question with a rag wet with MEK (methyl ethyl ketone)
2. Apply a coating of engine oil to a small area of the surface to be checked
3. Visual examination only

10. Select true statements concerning procedures and processes for stripping paints from metal surfaces. Write an "X" in the blanks before the correct answers.

_____a. Paint stripper should be brushed thoroughly into the finish being removed

_____b. Paint stripper will soften a polyurethane film but will not cause it to wrinkle or lift

_____c. For faster action, apply stripper and cover it with a polyethylene dropcloth

_____d. Paint stripper causes acrylic lacquers to wrinkle more quickly than it causes polyurethane to wrinkle, and it does not cause either to dissolve

_____e. Paint stripper penetrates the surface film of dope and dissolves it

_____f. Spray a thick layer of stripper on the finish to be removed so that the stripper will have adequate time to penetrate the film before the solvents evaporate

_____g. Paint stripper will soften the resins in most fiberglass components; therefore, the only way to remove finish from these parts is by sanding

11. Explain the cause of filiform corrosion and how it can be prevented by answering the following questions.

a. Filiform corrosion is most likely to form under which type of topcoat system?

_____

b. Incomplete conversion of which process will result in filiform corrosion?

_____

c. What is left trapped against the skin as a result of this incomplete conversion?

_____

d. What must the airframe technician ensure is present in the air to guarantee complete conversion of this process?

_____

12. Discuss the use and application of conversion coatings and wash primers by answering the following questions.

a. Why should a conversion coat be applied to an aluminum surface being prepared for refinishing?

_____

_____

_____

_____

b. Wash primers form an organic film which bonds well with the inorganic film left by conversion coatings. These films provide good protection for the metal surface and good adhesion for topcoats. Which topcoat system may be applied directly over wash primers?

_____

c. Generally, how long should wash primers cure before using?

_____

13. Select true statements concerning zinc chromate primer. Write an "X" in the blanks before the correct answers.

_____a. Zinc chromate is a good corrosion inhibitor, but it does not bond to the metal as well as some other primers

_____b. Green zinc chromate may be used on aluminum, but yellow zinc chromate may be used only on steel parts

_____c. Yellow zinc chromate will adhere well to bare metal, but green modified zinc chromate will not adhere satisfactorily

_____d. Zinc chromate protects the metal by forming an absolutely watertight film over the metal

_____e. Zinc chromate is satisfactory as a primer for use under oil-base enamels

14. Select true statements relative to acrylic lacquers and their application. Write an "X" in the blanks before the correct answers.

_____a. Acrylic lacquers normally have a high solid content

_____b. Acrylic lacquers may be applied over a two-part wash primer as soon as the primer is entirely dry

_____c. Old yellow zinc chromate primer may be used as an integral part of an acrylic lacquer finishing system

_____d. When using acrylic lacquer, several thin coats, rather than a few heavy coats, should be applied

15. Discuss the polyurethane finishing system by answering the following questions.

a. Does polyurethane have high or low solid content?

_____

b. What is the advantage of a polyurethane paint other than its good appearance?

_____

_____

c. Why should polyurethane be allowed to stand 15 to 30 minutes after being mixed with its catalyst?

_____

_____

d. How long should polyurethane be allowed to dry before applying masking tape?

_____

_____

e. What is meant by *pot life* when discussing polyurethane finishes?

_____

_____

_____

16. Select true statements concerning paint room safety practices and proper usage of respirators and masks. Write an "X" in the blanks before the correct answers.

_____a. Paint room should be equipped with vaporproof light fixtures to minimize fire hazards

_____b. Paint room should have exhaust fans located near the ceiling to rid the area of fumes

_____c. To prevent their contamination, finishing materials and equipment should only be stored in the paint room

_____d. A good-quality respirator mask can be depended upon to remove most paint fumes from the air

_____e. If you must stay in a room with a heavy concentration of fumes, you should wear an airflow-type mask which is slightly pressurized

17. Discuss air-supply requirements for painting by answering the following questions.

a. Why must the air supply used for finishing be free of oil and water?

_____

_____

_____

b. When determining the pressure being used on the spray gun, where should the measurement be taken?

_____

c. To what psi should the air pressure at the spray gun be adjusted?

_____

d. When adjusting the air pressure in the container of pressure-fed equipment, what pressure should generally be used?

_____

18. Select true statements concerning painting equipment. Write an "X" in the blanks before the correct answers.

_____a. A viscosity cup is used to measure the correct amount of reducers to add to finishing materials to obtain the proper viscosity for spraying

_____b. In an airless spraying system, the finishing material is atomized as it passes through a small orifice at a high velocity

_____c. An electrostatic spraying system uses a high-voltage electric charge on the spray gun to allow the charged finishing material to be attracted to the electrically grounded surface of the object being painted

_____d. The fluid tip is flush on a suction-fed gun in order to produce a low-pressure area as air passes over it pulling the material out of the cup

19. Identify parts of the following spray gun. Write the correct numbers in the blanks.

_____a. Atomizing air holes

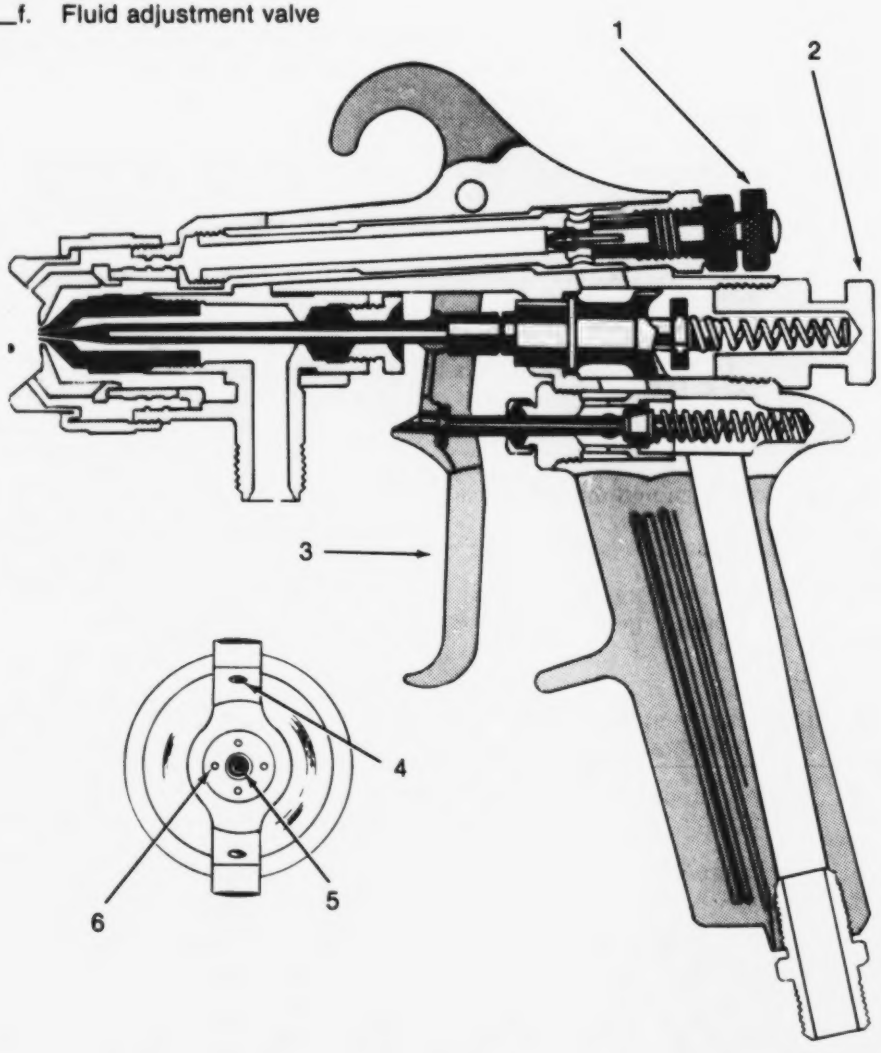
_____b. Fluid needle

_____c. Wing port air valve

_____d. Trigger air valve

_____e. Wing port holes

_____f. Fluid adjustment valve



20. Discuss the setup, adjustment, and cleaning of spray equipment by answering the following questions.

    a. A correctly adjusted spray gun should produce a uniform, fan-shaped spray, with the fan perpendicular or parallel to the wing ports?

    _____

    b. How can a spray pattern be adjusted from a round pattern to an elliptical pattern?

    _____

    _____

    c. What causes a jerky or intermittent spray?

    _____

    _____

    d. How often should a spray gun be thoroughly cleaned?

    _____

    _____

    e. How are hoses and spray guns cleaned after catalyzed materials such as epoxies and polyurethane have set up in them?

    _____

    _____

21. Match spray-pattern distortions to their causes. Write the correct numbers in the blanks.

    _____a. Plugged-up wing port hole on one side

    _____b. Material too thick for the amount of atomizing air

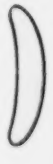
    _____c. Too much air through the wing port holes for the amount of material that is being sprayed

    _____d. Material buildup in the air cap

    1.

    2.

    3.

    4. 

22. Select statements concerning finish application. Circle the numbers before the correct answers

    a. When building up a coat of sprayed-on material, how much should each pass overlap the previous one?

        1) By all but two or three inches

        2) By two or three inches

        3) About halfway

        4) They need not overlap, just spray beside the last pass

    b. When spraying you should

        1) begin with the flat portions first, touching up the corners and edges last

        2) remember that as the spray gun arcs and gets farther away from the surface being painted, it will be necessary to increase the length of time that the paint is being applied in order to ensure a uniform application of the material

        3) begin the stroke, then pull the trigger just after passing the edge of the surface being painted; release the trigger just prior to reaching the far edge of the surface and before completing the stroke

        4) hold the gun 6 to 10 inches from the work area, and move the gun parallel to the surface being painted

    c. What is the usual cause of runs and sags in an aircraft finish?

        1) Too much material applied in one coat

        2) Material drying too fast

        3) Material is being applied too fast

        4) High atmospheric humidity

23. Discuss trim and registration number application by answering the following questions.

    a. In order to obtain a clear, sharp edge, what type of masking tape should be used when laying out trim?

    _____

    b. 1) When should you remove the masking tape used to outline trim?

    _____

    _____

2) How should the masking tape be removed?

_____

_____

c. What is used to remove masking tape that has remained on the surface of the aircraft too long?

_____

d. How tall should aircraft registration numbers be?

_____

e. If the spacing between letters is 2 inches, what should be the width of the following registration number?

N 1820 W — _____

24. Arrange in proper sequence the steps for painting an airplane. Write a "1" in the blank before the first step, a "2" in the blank before the second step, and so on.

_____a. Jack up the nose of the aircraft to lower the tail enough to allow easy access to the top of the fin

_____b. Paint the bottom of the wing starting at the root and working toward the tip, spraying chordwise

_____c. Properly position the aircraft in the paint room so that overspray will not be a problem

_____d. Paint the upper surface of the aircraft spraying across the fuselage and spanwise on the vertical and horizontal tail surfaces and the wing

_____e. Paint all of the difficult areas, such as the ends and leading edges of the ailerons and flaps

_____f. Paint the bottom of the fuselage working from the empennage forward to the engine, spraying lengthwise

_____g. Paint the bottom of the horizontal tail surfaces starting at the root and working outward, spraying chordwise

(NOTE: Test questions 25 and 26 are project guides. They are an important part of this test. If they have not been completed, check with your instructor.)

25. Finish a fabric-covered surface.

26. Apply registration letter to finished surface.

ANSWERS TO THEORY TEST

1.

a. 6	k. 11	u. 20	ee. 28
b. 4	l. 14	v. 12	ff. 34
c. 9	m. 23	w. 18	gg. 31
d. 1	n. 19	x. 26	hh. 29
e. 8	o. 17	y. 24	ii. 38
f. 2	p. 21	z. 27	jj. 36
g. 5	q. 13	aa. 25	kk. 39
h. 10	r. 15	bb. 32	ll. 35
i. 3	s. 22	cc. 30	mm. 37
j. 7	t. 16	dd. 33	

2. a. The sparking brushes could ignite the fumes that are stirred up
   b. Do not panic—place some kind of cover over the flame and smother it
   c. 1) Flush eyes with plenty of water, and consult a physician if eye irritation continues
      2) Use proper eye protection
   d. Static electricity caused by sanding could cause a spark to ignite fumes inside the structure
   e. 1) No
      2) Overspray is highly flammable, and static electricity from sweeping could ignite it

3. Because plasticizers have the tendency to migrate out of the dope film, the film can become brittle and crack or ringworm

4. b, c

5. a. Running or sagging
   b. Pressure-pot-type spray gun
   c. 1) Mix the final coat of pigmented dope with about 20 percent clear dope
      2) Spray on a number of very thin coats of pigmented dope, wet sanding between each coat
   d. Ultraviolent rays of the sun will attack the finish if it is not protected by the pigmented dope and will cause the surface to become dull and chalky looking

6.

a. 4	e. 6
b. 7	f. 2
c. 1	g. 5
d. 3	

7. a,c,e

8. a. 4
   b. 6
   c. 1
   d. 7
   e. 5
   f. 3
   g. 2

9. a. 2
   b. 1
   c. 1, 2
   d. 2
   e. 3

10. c, e, g

11. a. Polyurethane
    b. Wash primer
    c. Acid
    d. Sufficient moisture

12. a. It changes the surface of the metal into a chemically inert oxide film which protects the surface from corrosion
    b. All, including their primers
    c. 30 minutes

13. a, c, e

14. b, d

15. a. High
    b. It has a durable, hard, chemical-resistant, and abrasion-resistant finish
    c. To allow it to begin its curing action
    d. It is usually dry enough to tape in about five hours, but it is better to wait at least twenty-four hours
    e. The amount of time between the activating of the polyurethane with catalyst until the materials set up too much to use

16. a, e

17. a. Oil and water will cause defects in the finish, such as brown spots, fish eyes, poor adhesion, etc.
    b. At the gun
    c. Between 40 and 80 psi
    d. 5 to 15 psi

18. b, c

19. a. 6
    b. 5
    c. 1
    d. 3
    e. 4
    f. 2

20. a. Perpendicular
    b. By opening the spreader adjustment valve which allows air to flow out of the wing ports of the spray gun
    c. Air in the fluid line, caused by an air leak in this line or by too little finishing material in the cup
    d. After each use, before the material has a chance to set up
    e. Hoses must be discarded; the passages in the gun are cleaned by digging out the material

21. a. 4
    b. 3
    c. 1
    d. 2

22. a. 1
    b. 4
    c. 1

23. a. Polypropylene tape
    b. 1) As soon as the painted surface is no longer tacky to the touch
       2) By slowly pulling it almost parallel to the surface at an angle of about 170 degrees
    c. Alaphatic naptha
    d. 12 inches
    e. 56 inches

24. a. 6
    b. 5
    c. 1
    d. 7
    e. 2
    f. 4
    g. 3

25. Performance skills evaluated to the satisfaction of the instructor

26. Performance skills evaluated to the satisfaction of the instructor

AIRFRAME

A203 AIRCRAFT FABRIC COVERING, PAINTING, AND FINISHING

COURSE TEST

88-005614

TI-9207

AIRFRAME
A203 AIRCRAFT FABRIC COVERING, PAINTING, AND FINISHING
COURSE TEST

Read the following questions and darken the circle in the column of the corresponding letter which indicates the correct answer on the answer sheet.

1. The minimum allowable tensile strength of new grade A (TSO-C15) aircraft cotton fabric in pounds per inch warp and fill is

   a. 100.
   b. 65.
   c. 46.
   d. 80.

2. Fabric coverings are laced to the wing structure for the purpose of maintaining the contour of the airfoil and to prevent lifting and whipping of the fabric in flight. The lacings should be secured by the use of seine knots

   a. Positioned in the middle of, or along the edge of, the bottom capstrip.
   b. Tied on the outside and then pulled into the wing structure.
   c. Which should never extend above the adjacent wing surface.
   d. Positioned in the middle of the top capstrip for aircraft with a never-exceed speed of 150 mph or less.

3. When and how is finishing tape applied on a fabric-covered aircraft?

   a. Sewed or laced on before dope is applied.
   b. Doped on immediately prior to the finish coat.
   c. Doped on after the first or second coat of dope.
   d. Doped on at the same time the last coat of dope or lacquer is applied.

4. Prior to application of surface tape tc the trailing edge of a wing or control surface, the tape should be notched at intervals to

   a. Make it easier to apply to severe curvatures.
   b. Increase the length of the tape's edges for better doping.
   c. Prevent the entire tape from loosening in the event the tape begins to separate from the surface.
   d. Prevent raveling of the tape.

5. Surface or finish tape is installed on fabric-covered aircraft for what purpose?

   a. Prevent loosening of the entire fabric covering.
   b. Attach the fabric to the structure.
   c. Prevent wear over lacings, seams, corners, and edges.
   d. Prevent warping of the surface during drying period of the dope.

6. The best method of repair for a fabric-covered surface which has an L-shaped tear, each leg of which is approximately 14 inches long, is to

   a. Recover the entire bay in which the tear is located.
   b. Cut out the tear, sew in a new section, and then dope the new section to conform with the remainder of the surface.
   c. Sew from the end of each leg to the center of the tear with a baseball stitch and then dope on a patch.
   d. Sew with a baseball stitch from the center of the tear out toward the extremity of each leg and then dope on a patch.

7. The recommended procedure for making an unsewed (doped-on) fabric patch is to

   a. Cover the edges of all patches by applying pinked-edge surface tape with the second coat of clear dope.
   b. Dope-on the patch by means of initial coat of clear dope thinned 50 percent to obtain sufficient softening of the dope on the underlying fabric.
   c. Clean and remove all aluminum and color coats from the surface to which the patch is to be doped.
   d. Clean the area thoroughly and remove all color coats, aluminum, and clear dope from the surface to be covered by the patch, using acetone only.

8. A fabric-covered surface has a damaged area that measures 19 inches in one direction. How should the damaged area be repaired?

   a. Doped-on patch.
   b. Dope-in a new panel.
   c. Sewed-in patch.
   d. Sewed-in patch with doped-on surface patch.

9. When damage to a fabric-covered surface is such that it will permit a sewn-in repair patch, what type of stitch should be used?

   a. Half stitch.
   b. Modified seine.
   c. Baseball.
   d. Double loop.

10. Whenever it is necessary to install an unsewed patch, which of the following is a correct statement?

    a. A repair should return the original strength and tautness to the fabric.
    b. Remove old dope and paint by wire brushing down to base coat.
    c. A repair should return 70 percent of the original strength and tautness to the fabric.
    d. Install the patch over the color coats.

11. The letters and numbers of identification markings must be of a contrasting color and must be uniform in shape and size. The width of the characters must be

    a. One-half their height.
    b. Two-thirds their height.
    c. Equal to their height.
    d. Five times the width of the stroke.

12. Which statement is correct concerning aircraft registration numbers?

    a. All registered aircraft operating in the United States must display a registration number.
    b. Restricted category aircraft operating in the United States are not required to display a registration number.
    c. All aircraft located in the United States must display a registration number.
    d. Only normal and utility category aircraft must display a registration number.

13. When finishing a fabric surface, apply

    a. A minimum of eight coats.
    b. At least the number of coats necessary to result in a taut and well-filled finish job.
    c. The first three coats of dope by brush and the remaining five coats by spray gun.
    d. Three coats of clear, two coats of aluminum, and four coats of pigmented dope.

14. A practical method of determining whether a fabric surface has been finished with nitrate (cellulose nitrate) or butyrate (cellulose acetate) dope is to

    a. Press the thumb firmly against an unsupported section of the fabric and note the time required for the fabric to recover its original shape.
    b. Rub a small section with lacquer thinner. Butyrate finish will not be affected, but nitrate finish will be softened.
    c. Remove a 1-inch-wide strip of fabric and conduct a tensile test.
    d. Observe the reverse side of the fabric for evidence of blue dye (butyrate) or red dye (nitrate) that has penetrated as a result of brushing on the first two coats of dope.

15. The chief purpose of pigment (or aluminum) in dope is to

    a. Make it easier to apply.
    b. Make a more pleasing appearance.
    c. Give a covering that has a minimum of air resistance.
    d. Exclude sunlight from the fabric.

16. Whenever operations involving sanding, rubbing, or wiping of detached fabric-covered wings are to be performed, the surface should always be

    a. Coated with water to prevent overheating of the finish during the finishing process.
    b. Coated with water to prevent scratching of the finish during the finishing process.
    c. Located in a room in which the relative humidity is not more than 20 percent. By closely controlling the relative humidity, the material used for sanding, rubbing, or wiping will remain dry during the entire operation.
    d. Grounded to prevent accumulation of static charges during finishing process.

17. Fungicidal dopes are used in aircraft finishing as the

    a. First coat to prevent fabric rotting and are applied extremely thin to saturate the fabric.
    b. First full-bodied brushed-on coat to prevent fungus damage.
    c. Finish clear coat to provide a glossy appearance and to prevent deterioration of the fabric.
    d. Final full-bodied brushed-on coat to reduce blushing.

18. Before spraying a paint finish on cleaned aluminum, never

    a. Rinse off the surface with water.
    b. Touch the surface with bare hands.
    c. Blow off the surface with air.
    d. Suspend the surface in a dry room.

19. What is the usual cause of runs and sags in aircraft finishes?

    a. Too much material applied in one coat.
    b. Material drying too fast.
    c. Material is being applied too fast.
    d. High atmospheric humidity.

20. Which defect in aircraft finishes may be caused by moisture in the air supply line, adverse humidity, drafts, or sudden changes in temperature?

    a. Spray dust.
    b. Spray mottle.
    c. Blushing.
    d. Sags and runs.

21. Which statement is true regarding paint system compatibility?

a. Old-type zinc chromate primer may not be used directly for touch up of bare metal surfaces.
b. Acrylic nitrocellulose lacquers may be used over old nitrocellulose finishes.
c. Old wash primer coats may be overcoated directly with epoxy finishes.
d. Modified zinc chromate primer will adhere satisfactorily to bare metal.

NAME_____

DATE_____

AIRFRAME
A203 AIRCRAFT FABRIC COVERING, PAINTING, AND FINISHING
ANSWERS TO COURSE TEST

	a	b	c	d
1.	○	○	○	●
2.	●	○	○	○
3.	○	○	●	○
4.	○	○	●	○
5.	○	○	●	○
6.	○	○	○	●
7.	○	○	●	○
8.	○	●	○	○
9.	○	○	●	○
10.	●	○	○	○
11.	○	●	○	○
12.	●	○	○	○
13.	○	●	○	○
14.	○	●	○	○
15.	○	○	○	●
16.	○	○	○	●
17.	●	○	○	○
18.	○	●	○	○
19.	●	○	○	○
20.	○	○	●	○
21.	○	○	●	○